

CITY OF MURRIETA



MURRIETA CHILDREN'S LIBRARY EXPANSION PROJECT CITY PROJECT 23-458 CIP 21027

PLANS, SPECIFICATIONS, AND CONTRACT DOCUMENTS

ADDENDUM NO. 2

Posted to PlanetBids on July 9, 2025

The Bid due date and time HAVE CHANGED to:

Monday, July 21, 2025, before 5:00 pm

This file, plus the Addendum 2 Plan Set, constitute the entirety of Addendum 2.

1. The following sections contain:

- A. Section 01 56 39 Temporary Tree and Plant Protection that was inadvertently omitted from the original bid specifications.
 - B. A narrative of revisions and clarifications from SVA Architects to the Plans and Specifications.
 - C. An edited version of the Project Manual Including Specifications that was included in the original bid specification that started on page 186 of that file.
 - D. Addendum 2 Plan Set will be uploaded as a separate document to PlanetBids and labeled accordingly.
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SECTION 01 56 39

TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the protection and trimming and root pruning of trees that interfere with, or are affected by, execution of the Work, whether temporary or new construction.

1.2 SUBMITTAL

- A. The Contractor's representatives and employees shall be experienced in landscape maintenance.
- B. Certification from a qualified arborist that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
- C. Maintenance recommendation from a qualified arborist for care and protection of trees affected by construction during and after completing the Work.

1.3 QUALITY ASSURANCE

- A. Arborist Qualifications: An arborist certified by the International Society of Arboriculture or licensed in the jurisdiction where the Project is located.
- B. Tree Pruning Standards: Comply with ANSI A300, "Trees, Shrubs, and Other Woody Plant Maintenance--Standard Practices," unless more stringent requirements are indicated.
- C. Pre-installation Conference: Before starting tree protection and trimming, meet with representatives of authorities having jurisdiction, Owner, Landscape Architect, consultants, and other concerned entities. Review tree protection and trimming procedures and responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch sieve and not more than 10 percent passing a 3/4-inch sieve.
- B. Topsoil: Fertile, friable, surface soil, containing natural loam and complying with ASTM D 5268. Provide topsoil that is free of stones larger than 1 inch in any dimension and free of other extraneous or toxic matter harmful to plant growth.

Obtain topsoil only from well-drained sites where soil occurs in depth of 4 inches or more; do not obtain from bogs or marshes.

- C. Filter Fabric: Manufacturer's standard, non-woven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.
- D. Chain Link Fence: Metallic-coated steel chain link fence fabric, 0.120-inch- diameter wire size; 72 inches high, minimum; line posts, 1.9 inches in diameter; terminal and corner posts, 2-3/8 inches in diameter; top rail, 1-5/8 inches in diameter; bottom tension wire, 0.177 inch in diameter; with tie wires, hog ring ties, and other accessories for a complete fence system.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before construction begins, fertilize affected trees to improve tree vigor and health. Soil analysis testing should be completed to ensure fertilization with the appropriate fertilizer products.
- B. Temporary Fencing: Install temporary fencing located at or outside the drip line of trees.
- C. Protect tree root systems from damage due to noxious materials caused by runoff or spillage while mixing, placing, or storing construction materials. Protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.
- D. Do not store construction materials, debris, or excavated material within the drip line of remaining trees. Do not permit vehicles or foot traffic within the drip line; prevent soil compaction over root systems.
- E. Do not allow fires under or adjacent to remaining trees or other plants.

3.2 EXCAVATION

- A. Do not excavate within drip line of trees.
- B. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow tine spading forks and comb soil to expose roots.
 - 1. Cut roots approximately 3 inches back from new construction.
 - 2. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Protect roots from damage until they are permanently relocated and covered with soil.
 - 3. Where utility trenches are required within drip line of trees, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.

4. Root Pruning: Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with sharp pruning instruments; do not break or chop.

3.3 TREE PRUNING

- A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to written instructions of the qualified arborist.
- B. Root prune existing street trees to prevent sidewalk and curb damage.
- C. Prune remaining trees to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by qualified arborist.
- D. Pruning Standards: Prune trees according to ANSI A300 as follows:
 1. Crown cleaning.
 2. Crown thinning.
 3. Crown reduction.

3.4 TREE REPAIR AND REPLACEMENT

- A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to written instructions of the qualified arborist.
- B. Remove and replace dead and damaged trees that the qualified arborist determines to be incapable of restoring to a normal growth pattern.
- C. Provide new trees of the same size and species as those being replaced; plant and maintain as specified in Division 2 Section "Planting."

3.5 SOIL AERATION

- A. Aerate surface soil compacted during construction, 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 12 inches deep at 24 inches on center. Backfill holes with an equal mix of augured soil and sand.

3.6 DISPOSAL OF WASTE MATERIALS

- A. Burning is not permitted.
- B. Disposal: Remove excess excavated material, displaced trees, and excess chips from Owner's property.

END OF SECTION



Project: MURRIETA PUBLIC LIBRARY EXPANSION

Owner: CITY OF MURRIETA
1 TOWN SQUARE
MURRIETA, CA 90562

Architect: SVA Architects, Inc.
6 Hutton Centre Drive, Suite 1150, Santa Ana, California 92707

ADDENDUM 2

Revision: 07/09/2025

Note: The following revisions and clarifications to the Contract Documents (plans and specifications) shall become a part of the Contract Documents. All bidders are required to incorporate all necessary changes, additions, or deductions into their proposals.

1. ARCHITECTURAL

- A. A-62.2 – Roof Details:
 - i. Detail 6: Notes updated to reflect catch basin detail per Civil drawings
 - ii. Detail 11: Notes updated to reflect catch basin detail per Civil drawings
- B. A-0.2: Site Accessibility Notes: E: Delete note in its entirety, (a new site entry parking sign is not required in this project.)

2. CIVIL

- C. Sheet 16 – Miscellaneous Details
 - i. Revised trench section detail table to specify the minimum trench widths for 4” to 12” pipe.
- D. Drawing Sheet 1 – Water Improvement Plan
 - i. Revised number of Thrustblock from 5 to 4.
 - ii. Revised easement dimensions to 10’x21’ from 10’x10’
 - iii. Revised to remove note about repair of existing CMLC line.
 - iv. Revised graphic of pipe bend backflow preventer to connection to main.



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3. LANDSCAPE

- A. Sheet L4.501: Delete Carpentry Notes.
- B. Sheet L5.001: Updated water pressure note.
- C. Sheet L5.001: Updated Extra Wire Note.
- D. Sheet L5.001: Updated Irrigation legend with changes to subsurface irrigation, piping, misc. equipment, point of connection, and controller sections.
- E. Sheet L5.001: Added tree spacing note to notes section, removing it from P.O.C. notes.
- F. Sheet L5.101: Updated linetype scale of entire drawing.
- G. Sheet L5.101: Updated Irrigation legend with changes to subsurface irrigation, piping, misc. equipment, point of connection, and controller sections.
- H. Sheet L5.101: Added pull box symbols for extra wire and control wire locations.
- I. Sheet L5.101: Added point of connection notes for location of extra wires and control wire splice locations.
- J. Sheet L5.401: Detail C – Quick Coupler Valve, Update Notes.
- K. Sheet L5.401: Detail D– Trenching, Update callout on sleeving.
- L. Sheet L5.401: Detail G– Drip Indicator, Update detail.
- M. Sheet L5.401: Detail O: Update Deep Root Bubbler Model.
- N. Sheet L5.401: Details K – N (Dripline Connections): Update callouts to be Rainbird connectors/fittings.
- O. Sheet L5.401: Detail I – Update Manual Flush Valve detail.
- P. Sheet L5.401: Detail S– Regular Dripline Planting: Update Note.
- Q. Sheet L5.401: Detail C – Update Remote Control Valves for Spray, Callouts.
- R. Sheet L5.402: Detail H – Add Thrust Block detail.
- S. Sheet L5.402: Detail C – updated detail by removing rainbird notes and referencing legend.
- T. Sheet L5.501: Update General Irrigation Notes – Section D and E. Omit “gasket seal Mainline Pipe” Note. Update Sleeve Note and Sleeve/Pipe Cover section X and Y.
- U. Sheet L6.001: Updated Root barrier note.
- V. Sheet L6.401: Detail H – Update tree root barrier manufacturer.



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- W. Sheet L6.401: Detail T– updated detail and description of Tree Guying 36” Box and above.
- X. Sheet L6.401: Detail C and Q– combined details and updated details to reflect only staking and not staking and aeration.
- Y. Sheet L6.501: Removed section 7 related to “Weed eradication notes for hydroseeded slopes”.

4. SPECIFICATIONS

- A. Section 32 84 00 Landscape Irrigation: Section 2.9 Valve Boxes, dimensions and manufacturer updated. Section 2.10 Dripline Equipment, Air Relief Valve model and manufacturer specified. Section 3.5, Trenching notes updated.
- B. Section 32 92 00 Turf and Grasses: Section 2.1 TurfGrass Sod, update product type/manufacturer. Section 2.2 Planting Mix, update fertilizer and composition notes.
- C. Section 32 93 00 Landscape Planting: Section 2.5 Mulches, type and manufacturer updated. Section 2.7, Planting Soil Mix amounts updated.

5. BIDDER'S REQUEST FOR CLARIFICATION

- 1. Q: 12x6 connection for fire service is noted as hot tap, but existing main is noted as CMLC which is steel pipe and cannot hot tap, although on other sheets is noted as AC Pipe, which is OK to tap.
A: This was a direction from the Water District to hot tap which implies it is feasible.
- 2. Q: Test anode and station is noted in fire line drawing, but what is that connecting to? That is not common for non steel pipe installations.
A: Test anode and station is for the existing CMCL pipe.
- 3. Q: The 12" Storm Drain tie in is noted to pothole at PL, which implies that is the connection point, but removal is noted to main in street. Easement into street for that removal and potential new install is not noted.
A: The intent is to first verify whether the existing invert elevation at the property line can accommodate our proposed storm drain invert. If it does, we will connect to the existing storm drain lateral at the property line instead of extending to the storm drain main. However, if the existing invert at the property line does not meet our proposed design elevations, we will remove the existing lateral and extend a new connection to the existing storm drain main.



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4. Q: Catch basins at downspouts are detailed to be concrete per detail 4 on sheet 16, but in downspout detail at architectural drawings are noted as two different sizes of plastic NDS catch basins with wrapped gravel at area below catch basin.
A: Please proceed with concrete catch basin per Civil detail and plan.

5. Q: Trench detail is provided for trenches 18" or less, which require slurry backfill in paved areas, but min widths to each side of pipe are noted as 12" plus pipe OD, which implies trenches over 24" width also require slurry backfill. A considerable cost to consider.
A: The trench section widths are shown incorrectly. The detail is 12" max for the width of trench section from edge of pipe. The table provides the minimum trench widths. The 12" min dimension shown in the trench section is for the thrustblock. Revised trench section table for each pipe size.
4" pipe is 18" min. 28" max.
6" pipe is 18" min. to 30" max.
8" pipe is 24" min. to 32" max.
10" pipe is 24" min to 34" max.
12" pipe is 30" min to 36" max.

Reason: Revision & Clarification of Bid Documents

Distribution:

Bidders

Owner



PROJECT MANUAL
INCLUDING SPECIFICATIONS

FOR

MURRIETA PUBLIC LIBRARY EXPANSION

**8 TOWN SQUARE
MURRIETA, CA 92562**

Client Project Number: 21027

ARCHITECT

SVA ARCHITECTS

6 Hutton Centre Drive, Suite 1150
Santa Ana, CA 92707
Telephone: 949.809.3380

SVA Project Number: 2023-40136

07-09-2025

SECTION 00 01 10

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**PROJECT MANUAL
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Not used.

DIVISION 05 – METALS

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	05 50 00	Metal Fabrications
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Not used.

DIVISION 12 – FURNISHINGS

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DIVISION 13 – SPECIAL CONSTRUCTION

Not used.

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Not used.

DIVISION 21 – FIRE SUPPRESSION

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	33 30 00	Site Sanitary Sewer Utilities
	33 40 00	Storm Drainage Utilities

END OF SECTION

SECTION 02 41 10

STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Demolish existing construction as required for Project.
 - 1. Remove site structures including fence walls, trellis, gates, flatwork, landscaping, as indicated.
 - 2. Carefully remove, protect and deliver to owner items identified. Includes time capsule, dedication plaques, etc. Confirm with owner at pre-demolition walk through.
 - 3. Remove foundations including floor slabs.
 - 4. Cap and identify active utilities.
- B. Related Sections:
 - 1. Section 01 10 00: Summary of work including hazardous materials requirements.
 - 2. Section 01 50 00: Temporary facilities including barriers and waste management.
 - 3. Section 01 74 10: Waste management.
 - 4. Municipal Authorities: Dismantling, removing, and capping of Municipal utilities.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Do not interfere with use of adjacent buildings; maintain free and safe passage to and from.
 - 2. Prevent movement or settlement of adjacent structures, provide and place bracing or shoring and be responsible for safety and support of structures. Assume liability for movement, settlement, damage or injury.
 - 3. Cease operations and notify Architect immediately if safety of adjacent structures appears to be endangered; take precautions to properly support structures. Do not resume operations until safety is restored.
 - 4. Prevent movement, settlement or collapse of adjacent services, sidewalks, driveways and trees. Assume liability for such movement, settlement or collapse, promptly repair.
 - 5. Obtain permission from adjacent property owners when outriggers, swinging cranes or similar equipment traverse their property.
- B. Design/Build: Provide special engineering to ensure compliance with applicable codes and Contract Documents for shoring.

- C. Scheduling: Do not close or obstruct roadways without permits. Conduct operations with minimum interference to adjacent traffic.

1.3 SUBMITTALS

A. Action Submittals:

- 1. Submit demolition procedures and operational sequence to ensure Project sequencing is consistent with Owner needs.

B. Informational Submittal:

- 1. Submit copies of permits and notices authorizing demolition work.
- 2. Submit copies of certificates of severance of utility services.
- 3. Submit copies of permit for transport and disposal of debris.

- C. Pre-Demolition Photographs: Show conditions of exiting adjacent construction and site improvements that might be misconstrued as damaged by demolition operations. Submit before work begins.

- D. Design/Build Certificates: Submit certification signed by California licensed structural engineer indicating shoring compliance with code requirements.

1.4 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with **CALGreen** requirements including those relative to pollution control for construction waste.

1.5 SITE CONDITIONS

- A. Structures to be demolished shall be evacuated and their use discontinued before start of work.
- B. Arrange and pay for disconnecting or removing, capping and plugging utility services; disconnect and stub off; notify affected utility company in advance and obtain approval before starting Work.
- C. Place markers to indicate location of disconnected services; identify service lines and capping locations on Project Record Documents.
- D. Maintain access to existing walkways, exits, and adjacent occupied facilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Debris: Maintain possession of materials being demolished except where noted as a material for reinstallation or a material to be retained by Owner. Immediately remove debris from site.
- B. Materials for Reinstallation: Carefully remove, store and protect materials indicated to be reinstalled. Contact Owner and Architect prior to beginning demolition to determine extent of other materials that might be suitable for reinstallation.

1. Inventory and record condition of items to be reinstalled.
- C. Owner Retained Materials: Contact Owner prior to beginning demolition to determine extent of materials to be retained. Carefully remove materials indicated to be retained by Owner; deliver and store where directed.
 1. Inventory and record condition of items to be retained by Owner.

PART 3 - EXECUTION

3.1 DEMOLITION

- A. Demolish structures and appurtenances in an orderly and careful manner.
 1. Tanks: Remove tanks within construction area; pump out buried tanks located outside construction area, fill tanks with sand or fine gravel and cover with fill unless otherwise indicated.
- B. Perform demolition in accordance with authorities having jurisdiction.
 1. Do not use explosives.
- C. Keep work sprinkled to prevent dust; provide hoses and water as required for demolition. Coordinate potential availability of water from existing on-site water sources with Owner; do not use on-site water without prior written approval.
- D. Remove demolished materials from site, unless otherwise directed.
 1. Burning of materials on site is not permitted.
 2. Remove from site, contaminated, vermin infested, or dangerous materials encountered and dispose of by safe means so as not to endanger health of workers or public.
- E. Rough grade areas affected by demolition and leave level to within one percent; maintain grades and contours of site as indicated.
 1. Backfill over excavated areas, open pits and holes caused as a result of demolition which exceed excavation limits for project; use approved fill.
- F. Remove demolished materials, tools and equipment upon completion of work; leave site in condition acceptable to Architect.

3.2 REPAIR

- A. Repair damage to adjacent structures caused as result of demolition.
- B. Repair demolition beyond that required for Project.

END OF SECTION

SECTION 02 41 20

SELECTIVE BUILDING DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Selectively remove materials, systems, components, fixtures and equipment as designated and as required for completion of Project as indicated.
 - 1. Cap and identify active utilities.
 - 2. Prepare existing library for remodel. Coordinate phasing with owner to maintain operations of library throughout construction of expansion. Prepare phasing plan that limits the absolute minimum, shut downs and closures of the existing library. Maintain a clean and safe environment during work. Maintain egress during construction of the expansion via temporary protected walkways.
 - 3. Identify pathways through existing building for electrical, fire alarm, and low voltage conduits, etc. Prepare openings as required to access the work and make repairs to existing finishes to match adjacent finish.
 - 4. Prepare and submit a site/building logistics, phasing, and safety plan for owner and architect review prior to commencing work.
- B. Related Sections:
 - 1. Section 01 10 00: Summary of work including hazardous materials requirements.
 - 2. Section 01 50 00: Temporary facilities including barriers and waste management.
 - 3. Section 01 73 00: Cutting and patching.
 - 4. Section 02 41 10: Structure demolition.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Do not interfere with use of adjacent building spaces not in Project; maintain free and safe passage to and from.
 - 2. Prevent movement of structural components, provide and place bracing and be responsible for safety and support of structural components. Assume liability for movement, settlement, damage or injury.
 - 3. Cease operations and notify Architect immediately if safety of structural components appears to be endangered; take precautions to properly support structures. Do not resume operations until safety is restored.
 - 4. Prevent dust from selective demolition from contaminating adjacent occupied building areas; clean construction dust from adjacent occupied area immediately upon direction of Building Manager.

- B. Design/Build: Provide special engineering to ensure compliance with applicable codes and Contract Documents for support systems.
- C. Scheduling: Do not close or obstruct roadways without permits. Conduct operations with minimum interference to adjacent traffic.

1.3 SUBMITTALS

- A. Action Submittals: Submit selective demolition operational sequence to ensure Project sequencing is consistent with Owner needs.
 - 1. Prepare and submit a site/building logistics, phasing, and safety plan for owner and architect review prior to commencing work.
- B. Informational Submittals: Submit permits for transport and disposal of debris.

1.4 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control and for construction waste.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Debris: Maintain possession of materials being demolished except where noted as a material for reinstallation or a material to be retained by Owner. Immediately remove debris from site.
 - 1. Immediately remove from site wet materials and materials with water stains, with mold, and with mildew.
- B. Materials for Reinstallation: Carefully remove, store and protect materials indicated to be reinstalled. Contact Owner and Architect prior to beginning demolition to determine extent of other materials that might be suitable for reinstallation.
 - 1. Inventory and record condition of items to be reinstalled.
- C. Owner Retained Materials: Contact Owner prior to beginning demolition to determine extent of materials to be retained. Carefully remove materials indicated to be retained by Owner; deliver and store where directed.
 - 1. Inventory and record condition of items to be retained by Owner.

PART 3 - EXECUTION

3.1 EXISTING SERVICES

- A. Disconnect or remove utility services as required for completion of Project; disconnect, stub off, and cap utility service lines not required for new construction.
 - 1. Do not remove utilities discovered during demolition but not indicated without first determining purpose for utility; coordinate with Architect and Engineers.
- B. Do not disrupt services to adjacent building areas not in Project.
- C. Place markers to indicate location of disconnected services; identify service lines and capping locations on Project Record Documents.

3.2 DEMOLITION

- A. Demolish indicated appurtenances as indicated and as required for Project completion in an orderly and careful manner.
 - 1. Use methods that do not damage materials indicated to remain.
 - 2. Cut concrete and masonry using masonry saws and hand tools; provide sharp clean cuts requiring minimal patching for new construction.
 - 3. Use impact tools only where specifically approved in advance for areas where operations do not disturb building occupancy.
- B. Perform demolition in accordance with authorities having jurisdiction.
- C. Remove demolished materials from site, unless otherwise directed.
 - 1. Remove from site, contaminated, vermin infested, and dangerous materials encountered and dispose of by safe means so as not to endanger health of workers or public.
- D. Remove tools and equipment upon completion of work; leave area in condition acceptable to Owner and Architect.

3.3 REPAIR

- A. Repair damage to adjacent construction caused as result of this work.
- B. Repair demolition beyond that required.

END OF SECTION

SECTION 03 11 00

CONCRETE FORMWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Formwork for Cast-in-Place Concrete, with shoring, bracing and anchorage.
- B. Opening for other affected work.
- C. Form accessories.
- D. Stripping Forms.

1.2 REFERENCES

- A. CBC – California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 19.
- B. ACI 301 – Specifications for Structural Concrete.
- C. ACI 318 – Building Code Requirements for Structural Concrete.
- D. ACI 347R – Guide to Formwork for Concrete.
- E. PS 1-09 – Structural Plywood.
- F. APA – Form No. V345 – Concrete Forming Design/Construction Guide.

1.3 SYSTEM DESCRIPTION

- A. Design, engineer, and construct formwork, shoring, and bracing to meet design and code requirements, so that resultant concrete conforms to required shapes, lines, and dimensions.

1.4 QUALITY ASSURANCE

- A. Construct and erect concrete formwork in accordance with ACI 301.

1.5 REGULATORY REQUIREMENTS

- A. Conform to CBC – California Building Code, (CCR) California Code of Regulations, Title 24. Part 2.

1.6 COORDINATION

- A. Coordinate this section with other sections of work which require attachment of components to formwork.
- B. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.

1.7 PRODUCT HANDLING

- A. On delivery to project site, place materials in area protected from weather.
- B. Store materials above ground on framework or blocking and cover with protective waterproof covering providing for adequate circulation and ventilation. Handle materials to prevent damage.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

- A. Plywood: PS 1-09, BB Plyform grade, Class 1, Exterior Classification.
- B. Lumber: Douglas Fir Species; construction grade; with grade stamp clearly visible.
- C. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; 4 inches thick.

2.2 FORMWORK ACCESSORIES

- A. Form Ties: Snap-off metal of adjustable length; cone type; 1 inch break back dimension; free of defects that will leave holes no larger than one inch diameter in concrete surface.
- B. Form Release Agent: Colorless material which will not stain concrete, absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.
- C. Fillets for Chamfered Corners: Wood strips type; 3/4 x 3/4 inch size; maximum possible lengths.
- D. Dovetail Anchor Slots: Minimum 22 gage galvanized steel; foam filled; release tape sealed slots; bent tab anchors; securable to concrete formwork; manufactured by Heckmann Building Products Co., www.heckmannbuildingprods.com
- E. Flashing Reglets: 26 gage thick galvanized steel, longest possible lengths; release tape sealed slots; with alignments splines for joints; securable to concrete formwork; Type CO reglet manufactured by Fry Reglet, www.fryreglet.com
- F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages; Sized as required; of strength and character to maintain formwork in place while placing concrete.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify lines, levels, and measurements before proceeding with formwork.

3.2 PREPARATION

- A. Obtain Architect's approval for use of earth forms for footings.
- B. Minimize form joints. Symmetrically align joints and make watertight to prevent leakage of mortar.
- C. Arrange and assemble formwork to permit stripping, so that concrete is not damaged during its removal.
- D. Arrange forms to allow stripping without removal of principal shores, where required to remain in place.

3.3 ERECTION

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Provide bracing to ensure stability of formwork. Strengthen formwork liable to be overstressed by construction loads.

- C. Obtain approval before framing openings in structural members which are not indicated on Drawings.
- D. Do not displace or damage vapor barrier placed by section 03 30 00.
- E. Construct formwork to maintain tolerances in accordance with ACI 301.

3.4 APPLICATION OF FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.
- B. Do not apply form release agent where concrete surfaces are scheduled to receive applied coverings which may be affected by agent. Soak contact surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for work embedded in or passing through concrete.
- B. Coordinate work on other sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.
- C. Install accessories in accordance with manufacturer's instructions, level and plumb. Ensure items are not disturbed during concrete placement.

3.6 FORM REMOVAL

- A. Do not remove forms and bracing until concrete has sufficient strength to support its own weight and imposed loads.
- B. Do not damage concrete surfaces during form removal.
- C. Store reusable forms for exposed architectural concrete to prevent damage to contact surfaces.

3.7 CLEANING

- A. Clean forms to remove foreign matter as erection proceeds.
- B. Ensure that water and debris drain to exterior through clean-out ports.

3.8 EARTH FORMS

- A. Construct wood edge strips at top sides of excavations as indicated on drawings.
- B. Provide forms for footings and foundation walls wherever concrete cannot be placed against solid earth.
- C. Remove loose dirt and debris from form area prior to concrete placement.
- D. Concrete for foundations may be placed directly into neat excavations provided the foundation trench walls are stable as determined by the Architect Structural Engineer.
- E. When earth formed foundations are used, the minimum formwork shown on the drawings is mandatory to insure clean excavations prior to and during concrete placement.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Reinforcing steel bars, welded steel wire fabric, fabricated steel bar or rod mats for cast-in-place concrete.
- B. Support chairs, bolsters, bar supports, and spacers, for supporting reinforcement.

1.2 REFERENCES

- A. CBC – California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter **19**.
- B. ACI 301 – Specifications for Structural Concrete.
- C. ACI 318 – Building Code Requirements for Structural Concrete.
- D. ACI 315R (MNL-66) – Guide to Presenting Reinforcing Steel Design Details.
- E. ASTM A615 – Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- F. ASMT A706 – Standard Specification for Low Alloy Steel Deformed Bars for Concrete Reinforcement.
- G. ASTM A1064 – Carbon Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- H. ASTM C1116 – Specification for Fiber-Reinforced Concrete and Shotcrete.
- I. AWS D1.4 – Structural Welding Code Reinforcing Steel.
- J. CRSI – Manual of Practice.
- K. CRSI – Placing Reinforcing Bars.

1.3 QUALITY ASSURANCE

- A. Perform concrete reinforcement work in accordance with CRSI Manual of Standard Practice.
- B. Conform to ACI 301 and ACI 315R (MNL-66).
- C. Conform to CBC California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.

1.4 SUBMITTALS

- A. Submit under provisions of Submittal Procedures.
- B. Shop Drawings:
 - 1. Comply with requirements of ACI MNL-66. Include the following:
 - a. Complete bar layout.
 - b. Representative sections.
 - c. Details for congested conditions.
 - d. Proposed layout where vertical and horizontal bars intersect.
 - e. Bar schedules.
 - f. Typical bending diagrams and offsets.

- g. shapes of bent bars.
- h. Spacing of bars.
- i. Splice lengths and locations.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Reinforcing steel: ASTM A615, Grade 40 for No.4 bars and smaller, Grade 60 for No.5 bars and larger. Billet-steel deformed bars, uncoated finish.
- B. Welded reinforcement: ASTM A706, Grade 60, deformed bars, unfinished.
- C. Welded steel wire fabric: ASTM A1064 plain type; coiled rolls; uncoated finish.
- D. Steel wire: ASTM A1064, plain, cold drawn steel.

2.2 ACCESSORY MATERIALS

- A. Tie wire: Minimum 16 gage annealed type.
- B. Chairs, bolsters, bar supports, spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete including load bearing pad on bottom to prevent vapor barrier puncture.

2.3 FABRICATION

- A. Fabricate in accordance with ACI 315R (MNL-66), providing concrete cover specified in Section 30 30 00.
- B. Locate reinforcing splices not indicated on Drawings at points of minimum stresses.
- C. Weld reinforcing bars in accordance with AWS D1.4.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Before placing concrete, clean reinforcement of foreign particles or coatings.
- B. Place, support, and secure reinforcement against displacement. Do not deviate from alignment or measurement.
- C. Mix fibrous reinforcement into concrete material according to Section 03 30 00.
- D. Do not displace or damage vapor barrier required by Section 03 30 00.

3.2 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 29.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Cast-in-place concrete foundation walls, and footings.
- B. Slabs on vapor barrier.
- C. Control, expansion, and contraction joint devices associated with concrete work.
- D. Curing and Sealing Compound
- E. Not Used
- F. Retaining walls, Utility slabs
- G. Equipment pads, Thrust blocks, Light pole bases, Flag Pole Bases

1.2 REFERENCES

- A. The 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. CBC - California Building Code, (CCR) California Code of Regulations Title 24, Part 2, Chapter 19.
- C. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- D. ACI 301 - Specifications for Structural Concrete.
- E. ACI 302.1R - Guide for Concrete Floor and Slab Construction.
- F. ACI 305.1 - Specification for Hot Weather Concreting.
- G. ACI 306.1 - Standard Specification for Cold Weather Concreting.
- H. ACI 318 - Building Code Requirements for Structural Concrete.
- I. ASTM C33 - Concrete Aggregates.
- J. ASTM C94 - Ready-Mixed Concrete.
- K. ASTM C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars.
- L. ASTM C150 - Portland Cement.
- M. ASTM C289 - Potential Reactivity of Aggregate.
- N. ASTM C309 - Liquid Membrane Forming Compound.
- O. ASTM C330 - Lightweight Aggregates for Structural Concrete.
- P. ASTM C494 - Standard Specifications for Chemical Admixtures for Concrete.
- Q. ASTM C618- Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- R. ASTM C932 - Surface-Applied Bonding Agents.
- S. ASTM C1315 - Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
- T. ASTM C1602 - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
- U. ASTM D226 - Asphalt Saturated Organic Felt used in Roofing and Waterproofing.
- V. ASTM D1751 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction.
- W. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- X. ASTM E154 - Standard Test Methods for Water Vapor Retardants used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

- AA. ASTM E1643 - Installation of Water Vapor Retarders used in Contact with Earth or Granular Fill Under Concrete Slab.
- BB. ASTM E1155 - Determining Floor Flatness and Levelness Using the F-Number System.
- CC. ASTM E1745 - Standard Specifications for Plastic Water Vapor Retarders Used in Contact with Soil Or Granular Fill Under Concrete Slabs.
- DD. ASTM F1249 - Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
- EE. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- FF. National Ready Mix Concrete Association - Plant Certification Program. GG. Stormwater Best Management Practice Handbook (BMP Handbook), Construction Edition, as published by the California Storm Water Quality Association.

1.3 QUALITY ASSURANCE

- A. Perform work in accordance with ACI 301.
- B. Installation of vapor barrier shall be in accordance with ASTM E1643 and manufacturer's installation guides and recommendations. Provide Architect written site reports from manufacturer's field service representative, indicating observation of vapor barrier installation prior to concrete placement.
- C. Obtain concrete materials from same source throughout the Work.

1.4 QUALIFICATIONS

- A. Manufacturer: Manufacturer of ready-mix concrete products complying with ASTM C94 requirements for production facilities and equipment. Certified according to National Ready Mix Concrete Associates Plant Certification Program.

1.5 DESIGN MIX

- A. Submit design mix for each class of concrete, prepared by a California Registered Civil Engineer, to Testing Laboratory and Architect for review.

1.6 REGULATORY REQUIRMENTS

- A. Conform to CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- B. Conform to CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, and the 2010 ADA Standards for Accessible Design for access requirements for individuals with disabilities.

1.7 SUBMITTALS

- A. Submit product data and manufacturer's instructions for all accessories.

1.8 FIELD SAMPLE

- A. Provide field sample of finish.

- B. Provide minimum 3'x3' sample panel to be reviewed by architect.
- C. Accepted sample may not remain as part of work.
- D. Field sample will demonstrate minimum standard of the work.

1.9 PRE-INSTALLATION CONFERENCE

- A. Convene a conference two weeks prior to commencing placement of floor slab work of this section.
- B. Require attendance of parties directly affecting the work of this Section.
- C. Agenda:
 - 1. Placement of subgrade beneath floor slab.
 - 2. Testing of subgrade beneath floor slab.
 - 3. Delivery and placement of concrete.
 - 4. Testing and inspection procedures for concrete.
 - 5. Submittal of mix design for concrete.
 - 6. Hot and cold weather concreting procedures.
 - 7. Vapor barrier location and installation.
 - 8. Placement of control and expansion joints.
 - 9. Steel reinforcement installation.
 - 10. Installation of inserts and embedded items.
 - 11. Finishes and finishing.
 - 12. Forming and form removal limitations.
 - 13. Floor slab flatness and levelness requirements.
 - 14. Curing process and procedures.
 - 15. Protection of finished floor slabs.
 - 16. Floor slab joint and crack repair.
 - 17. Moisture vapor transmission testing.

1.10 WARRANTY

- A. Provide fifteen year warranty from curing, hardening and vapor barrier compound manufacturer.
- B. Warranty: Include coverage for removal and replacement of finish floor materials that delaminate from interior floor slabs due to moisture migration and excessive vapor emissions or due to presence of efflorescence and alkali contaminates.
 - 1. Subfloor Moisture Conditions: Moisture emission rate of no more than 3 lb/1000 sq. ft./24 hours when tested by Quantitative Anhydrous Calcium

Chloride Test, ASTM F1869, with subfloor temperature not less than 65 degrees F.

2. Subfloor Alkalinity Conditions: A pH range of between 5 to 9 when subfloor is wetted with potable water and pHdrion paper is applied.
3. Warranty to be supported by \$1,000,000.00 product liability insurance policy issued directly to the Owner.

1.11 ENVIRONMENTAL REQUIREMENTS

- A. Provide concrete curing, finishing, and waste management techniques as defined in Section 4 of the Storm Water Best Management Practice Handbook, (BMP Handbook) Construction Edition.

PART 2 - PRODUCTS

2.1 FORMWORK

- A. As specified in Section 03 11 00.

2.2 REINFORCEMENT

- A. As specified in Section 03 20 00.

2.3 FIBROUS REINFORCEMENT

- A. As specified in Section 03 20 00.

2.4 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I or Type II Portland type; low alkali; grey color.
- B. Fine and Coarse Aggregates Normal Weight Concrete: ASTM C33, non reactive when tested in accordance with ASTM C289 and Appendix X-1 of ASTM C33.
- C. Fine and Coarse Aggregate, Light Weight Concrete: ASTM C330.
- D. Water: ASTM C1602, clean and not detrimental to concrete.

2.5 ADMIXTURES

- A. Fly Ash: ASTM C618, Class F
- B. Water Reducing Admixture: ASTM C494, Type A
- C. Calcium Chloride, or any other admixtures not allowable

2.6 VAPOR BARRIER

- A. Material: 15 mil thick polyethylene film meeting the requirements of ASTM E1745, Class A, with a maximum permance of 0.01 perms in accordance with ASTM E96/E154, Section 7, and a Water Vapor
- B. Transmission Rate (WVTR) of less than 0.0037 when tested according to ASTM F1249.

1. Accessories:

- a. Minimum 4 inch wide polyethylene seaming tape with pressure sensitive adhesive.
- b. Minimum 6 inch wide multi-layered textured polyethylene concrete bonding tape.
- c. Polymer-modified liquid vapor retarder mastic.
- d. PVC termination bar with pre-drilled holes.
- e. All accessories provided by vapor barrier manufacturer.

2. Manufacturers:

- a. Fortifiber Building Products, www.fortifiber.com.
- b. Poly-America, www.yellowguard.com.
- c. Reef Industries, www.reefindustries.com.
- d. Stego Industries, www.stegoindustries.com.
- e. Substitutions: Under Provisions of Section 01 23 45.

2.7 ACCESSORIES

- A. Underlayment: ASTM D226, Type I (No. 15) asphalt saturated roofing felt.
- B. Bonding Agent: ASTM C932; Weld-Crete as manufactured by Larsen Products Corp., www.larsenproducts.com.
- C. Non-shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 7000 psi in 28 days.
- D. Joint Filler: ASTM D1751, 1/2 inch thick.
- E. Sand Fill: Manufactured "crusher run" sand free of silt, clay, loam, friable or soluble materials or organic matters, all passing the No. 4 sieve and only 5 percent passing the No. 200 sieve.
- F. Curing, Hardening and Vapor Barrier Compound: ASTM C1315, Type I, Class A and ASTM C309, Type 1, Class A, with maximum volatile organic compound (VOC) content rating as required to suit regulatory requirements. Material to have no less than 34 percent penetrating solids, have no visible sheen and be compatible with floor finish materials and overlayments. Provide the following:

PMC 3300 Penetrating Sealer manufactured by Curranseal, www.curranseal.com.
- G. Sealing Compound: Ashford Formula manufactured by Curecrete Distribution, Inc., www.ashfordformula.com.
- H. Slip Resistant Aggregate: 95 percent minimum fused homogeneous aluminum oxide.

- I. Chemical Concrete Stain: Penetrating reactive concrete stain and clear sealer of color selected by Architect. Subject to compliance with requirements provide one of the following:
 - a. Blush-Tone Acid Stain as manufactured by Rafco Products Co., www.brickform.com.
 - b. Lithochrome Chemstain as manufactured by L.M. Scofield Co., www.scofield.com.
 - c. ChlorStain as manufactured by Super Stone, Inc., www.superstone.com.
 - d. Patina Stain System as manufactured by the Symons Corporation, www.symons.com.
 - e. SGS Concrete Stain as manufactured by Solomon Grind Chemical Services, www.solomoncolors.com.
 - f. SC-30 Acid Stain as manufactured by Westcoat Specialty Coating Systems, www.westcoat.com.
 - g. Concrete Floor Slab, Saw Cut, Joint, Crack, Repair Material: Cement-based, polymer-modified product that can be feathered at edges to match adjacent floor elevations. Compressive strength not less than 4,200 psi at 28 days when tested according to ASTM C109. Equivalent to ARDEX SD-F Feather Finish, www.ardex.com. Epoxy base to be equivalent to W.R. Meadows Rezi-Weld Flex semi-rigid epoxy, www.wrmeadows.com.
 - h. Substitutions: Under provisions of Section 01 25 13.

2.8 CONCRETE MIX

- A. Mix concrete in accordance with ASTM C94, ACI 318, Section 26.4.4.
- B. Walls, Footings, Grade Beams, and Caissons, : Proportion normal-weight concrete mixture as follows:
 1. Minimum compressive strength at 28 days: 3,500 psi
 2. Maximum water-cement ratio: 0.45
 3. Maximum aggregate size: 1 inch
 4. Slump Limit: 4 inch minimum, 6 inch maximum
 5. Fly ash: Maximum 15 percent by weight
 6. Waterproofing admixture: 3 percent by weight of cement
- C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
 1. Minimum compressive strength at 28 days: 4,000 psi
 2. Minimum Cement Materials Content: 540 lb/cu. yd.
 2. Maximum water-cement ratio: 0.45

3. Maximum aggregate size: 3/4 inch
4. Slump Limit: 3 inch minimum, 5 inch maximum
5. Fly ash: Maximum 15 percent by weight
6. Waterproofing admixture: 3 percent by weight of cement

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, held securely, and will not cause difficulty in placing concrete.

3.2 PREPARATION

- A. At locations where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels, and pack solid with non-shrink grout.
- B. Place 2 inch thick sand fill over subgrade.
- C. Compact sand fill as specified in Geotechnical Report.
- D. Install underlayment over wood subfloor. Lap joints 6 inches. Fasten in place.

3.3 VAPOR BARRIER

- A. Install vapor barrier in compliance with ASTM E1643 under interior slabs over sand subgrade.
- B. Install vapor barrier to exterior surface of below grade building foundation walls and grade beams. Seal to vertical surface of foundation wall with pressure sensitive tape and termination bar at an elevation consistent with the top of the adjacent finish grade.
- C. Lay vapor barrier with long dimension parallel with long dimension of space.
- D. Lap vapor barrier over footing and seal to vertical surface of interior foundation wall with pressure sensitive tape and termination bar at an elevation consistent with the top of the slab or terminate vapor barrier at horizontal edge of slab and foundation wall with continuous strip of concrete bonding tape.
- E. Overlap all joints in vapor barrier 6 inches and seal with tape.
- F. Seal all pipe penetrations of vapor barrier with pipe boot fabricated from vapor barrier material, tape and mastic.
- G. Repair damaged areas with vapor barrier, overlapping damaged area by 6 inches and taping all four sides.

3.4 PLACING CONCRETE

- A. Notify Architect minimum 24 hours prior to commencement of concreting operations.
- B. Place concrete in accordance with ACI 301.
- C. Hot Weather Placement: ACI 305.1.
 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature,

provided water equivalent of ice is calculated to total amount of mixing water.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete in hot weather. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
- D. Cold Weather Placement: ACI 306.1.
 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 306.1
- E. Ensure reinforcement, inserts, embedded parts and formed joints are not disturbed during concrete placement.
- F. Do not disturb or damage vapor barrier while placing concrete. Repair damage as required to maintain integrity of barrier.
- G. Place concrete continuously between predetermined construction and control joints. Do not break or interrupt successive pours such that cold joints occur.
- H. Place interior floor slabs on fill in a strip sequence pattern.
- I. Excessive honeycomb or embedded debris in concrete is not acceptable.

3.5 JOINTS

- A. Saw cut control joints at an optimum time after finishing. Use 3/16 inch thick blade, cutting 1/3 into depth of slab thickness.
- B. Review locations of joints when indicated and make recommendations for any additional joints or suggestions for new locations. Lack of joints or misplacement of joints will not constitute justification of slab cracking.
- C. Provide control joints at 15 feet on center unless otherwise indicated.
- D. Where indicated on the drawings, separate slabs from vertical surfaces with joint filler. Extend joint filler from bottom of slab to within 1/4 inch of finished slab surface.

3.6 FLOOR SLAB JOINT FILLING AND CRACK REPAIR

- A. Prepare, clean, and install joint repair material according to manufacturer's written instructions.
- B. Defer joint filling and crack repair until concrete has aged a minimum of 60 days.
- C. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- D. Mechanically V-groove as necessary all saw cuts, joints and cracks, to a minimum width of 1/4 inch and a minimum depth of 5/8 inch.
- E. Fill bottom of joint at slab on grade locations to a depth of at least 3/16 inch with semi-rigid epoxy. Omit semi-rigid epoxy at above grade slab locations.
- F. Place silica sand over epoxy filler.
- G. Prepare and prime joint substrate as recommended by joint repair material manufacturer.
- H. Fill all saw cuts, joints, and cracks with cement based joint repair material to top of concrete surface.
- I. Steel trowel edges of joint repair material to a feather edge to match adjacent floor elevation.

3.7 FINISHING OF FORMED SURFACES

- A. Rough form finish:
 - 1. Leave surfaces with the texture imparted by forms, except patch tie holes and defects.
 - 2. Remove fins exceeding 1/4 inch in height.
 - 3. Use for below grade foundation walls and concealed spaces.
- B. Smooth form finish:
 - 1. Coordinate as necessary to secure form construction using smooth, hard, uniform surfaces, with number of seams kept to a practical minimum and in a uniform and orderly pattern.
 - 2. Patch tie holes and defects.
 - 3. Remove fins completely.
 - 4. Use for exposed finish surfaces to receive paint.
- C. Smooth rubbed finish:
 - 1. Produce on newly hardened concrete no later than the day following form removal.
 - 2. Wet the surfaces, and rub with carborundum brick or other abrasive until uniform color and texture are produced.
 - 3. Do not use a cement grout other than the cement paste drawn from the concrete itself by the rubbing process.
 - 4. Use for exposed finish surfaces to receive clear sealer.
- D. Grout Cleaned Finish:
 - 1. Do not start cleaning operations until all contiguous surfaces to be cleaned are completed and accessible.
 - 2. Do not permit cleaning as the work progresses.
 - 3. Mix one part Portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout having the consistency of thick paint.
 - 4. Wet the surface of the concrete sufficiently to prevent absorption of water from the grout and apply the grout uniformly with brushes or spray gun.
 - 5. Immediately after applying the grout, scrub the surface vigorously with a cork float or stone to coat the surface and fill all air bubbles and holes.
 - 6. While the grout is still plastic, remove all excess grout by working the surface with a rubber float, sack, or other means.
 - 7. After the surface whites from drying (about 30 minutes at normal temperatures), rub vigorously with clean burlap.
 - 8. Keep the surface damp for at least 36 hours after final rubbing.
 - 9. Use for repair of exposed finish surfaces to receive paint or clear sealer and for exposed to view exterior foundation stem walls.
- E. Medium Sandblast Finish:
 - 1. Concrete must have cured a minimum of 14 days prior to sandblasting.
 - 2. Perform sandblasting finishing in as continuous an operation as possible, utilizing same work crew to maintain continuity of finish on each surface or area of work.

3. Maintain depth of cut and general aggregate exposure to match field sample.
4. After sandblasting to required finish, wash to clean exposed aggregate surfaces to match Architect's sample.

3.8 FINISHING SLABS

- A. Uniformly spread, screed and consolidate concrete. Do not spread concrete by vibration.
- B. Float Finish: Float with hand float or with a powered disc float. High spots to be cut down and low spots to be filled. Use as preparation for further finishing.
- C. Scratched Finish: Mechanically float surfaces. Roughen with stiff brushes before final set.
- D. Troweled Finish: After floating, steel trowel to smooth, mark free surface.
- E. Fine Broom Finish: After floating and while the surface is still plastic, provide a fine textured finish by drawing a fine fiber bristle broom uniformly over the surface in one direction only.

3.9 CHEMICALLY STAINED CONCRETE FINISH

- A. Concrete surfaces shall have cured a minimum of 28 days prior to stain application.
- B. Apply chemical stain to concrete surfaces as indicated on the drawings.
- C. Apply stain evenly over surface in quantities according to manufacturer's recommendations.
- D. Do not apply stain when temperature is above 85 degrees F.
- E. Maintain a wet edge on surfaces during application.
- F. Remoisten concrete to blend hard edges or lap marks caused by application.
- G. Flush area of stain application with mixture of water and baking soda after stain has dried.
- H. Prevent water rinse runoff to planted areas or other surfaces that may be damaged by stain residue.
- I. Apply manufacturer's recommended sealer to stained surfaces. Apply in accordance with manufacturer's recommendations.

3.10 SLAB TOLERANCES

- A. Maintain slab tolerance as defined in ACI 302.1R of (SOV) FF35 and FL25 and (MLV) FF24 and FL17 as measured by ASTM E1155 for slabs on grade.
- B. Correct the slab surface if the actual FF/FL number for the floor installation measures less than required.
- C. After correction of slab surface to specified tolerance, apply curing, hardening and vapor barrier over corrected surface.
- D. In areas of floor drains, maintain floor levels at the walls and slope surface uniformly to drains at 1/8 inch per foot.

3.11 CURING

- A. Apply curing, hardening and vapor barrier compound on all floor slabs that are not exposed and indicated to be sealed.

- B. Cure concrete surfaces in accordance with ACI 301.
- C. Spray apply curing, hardening and vapor barrier compound on finished slab surfaces located below grade, at grade, and above grade in two "wet on wet" flood coats at the total rate of 200 sq. ft./gallon in accordance with manufacturer's instructions.
- D. Application of compound shall be by a trained applicator acceptable to compound manufacturer.
- E. After application of curing, hardening, and vapor barrier compound, moist cure concrete using the following method:
 - 1. Spraying: Fog spray clean, potable water over floor slab areas and maintain moist for 10 days.
 - 2. Polyethylene Film: Spread over floor slab areas, lap edges and sides, maintain in place for 10 days.

3.12 SEALING

- A. Apply sealing compound on finished floor slab surfaces that are not to receive a finished floor covering and are indicated to be exposed and sealed.
- B. Apply sealing compound immediately following finishing operation.
- C. Apply sealing compound in sufficient quantities to keep entire surface wet for a minimum of 30 minutes.
- D. Lightly mist surface with water as compound is absorbed into surface.
- E. Flush surface with water and squeegee surface free of excess compound.
- F. Burnish final concrete surface with propane burnisher.

3.13 PATCHING

- A. Notify Architect immediately upon removal of forms to determine areas that will require patching.
- B. Surface defects shall include color and texture irregularities, stains, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections and discolorations in the surface that cannot be removed by cleaning.
- C. Patch imperfections in accordance with ACI 301.

3.14 DEFECTIVE CONCRETE

- A. Modify or replace concrete not conforming to required levels and lines, details, and elevations.
- B. Repair or replace concrete not properly placed or of the specified type.

3.15 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 29.
- B. Owner's Inspector will take cylinders and perform slump, air entrainment, temperatures, density, and compressive strength cylinder tests per ACI 301. Preparing compressive strength test cylinder shall be per ACI 301 and the number of cylinders for a valid 28-day compressive strength test shall be determined in accordance with ACI 318, Item 26.12.1 (a). Project Inspector will arrange for pickup by Testing Laboratory.

- C. Three cylinders will be taken for every 50 yards, or fraction thereof, for each class of concrete for each day.
- D. Tests of cement and aggregates will be performed by Testing Laboratory to ensure conformance with requirements stated herein.
- E. Slab tolerance as measured by ASTM E1155 shall be performed within 72 hours of floor slab installation.
- F. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.16 PROTECTION

- A. Protect finished work under provisions of Section 01 61 00.
- B. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

END OF SECTION

SECTION 03 35 15

SEALED CONCRETE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide applied curing, hardener, sealer type curing compound to concrete flooring including preparation of concrete as required for complete installation.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Meeting: Convene not less than one week prior to commencing concrete placement, including applying hardener sealer, at areas indicated to have a hardener sealed finish.
 - 1. Require attendance of those directly affecting work of this Section.
 - 2. Review concrete installation and coordinate required preparation.

1.3 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature for each type of material involved in curing, hardener, sealer for concrete.
- B. Samples: Furnish sample panels of concrete with curing, hardener, sealer applied to half of surface; indicate which half has hardener sealer.
- C. Maintenance Instructions: Provide written instructions for recommended periodic maintenance.

1.4 QUALITY ASSURANCE

- A. Curing, Hardener, Sealer Installers: Firms with not less than five years successful experience applying specified curing, hardener, sealer and acceptable to system manufacturer.
- B. Mock-Up: Erect minimum 10 square feet of concrete flooring with curing, hardener, sealer at location as approved. Approved mock-up may be incorporated into Project.

PART 2 - PRODUCTS

2.1 SYSTEM MANUFACTURERS

- A. Nox-Crete Products Group (800.669.2738).
- B. W.R. Meadows, Inc. (800.342.5976).
- C. PROSOCO, Inc. (800.255.4255).

- D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide applied curing, hardener, sealer to concrete flooring.
- B. Regulatory Requirements, VOC Emissions: Comply with applicable limitations for volatile organic compound (VOC) emissions for concrete sealing materials.
- C. Accessibility Regulatory Requirements: Provide for assuring access for persons with disabilities in accordance with state and federal regulations for slip resistance.
 - 1. California Regulations: Comply with California Building Standards Code.
 - 2. Federal Regulations: Comply with Americans with Disabilities Act (ADA) Standards.
 - 3. Slip-Resistant Hard Surfaces: Hard surface finishes to comply with requirements of authorities having jurisdiction for slip-resistant hard surfaces, including general code requirements and requirements for access for persons with disabilities.
- D. Hardener, Sealer, Densifier: Provide water borne penetrating lithium silicate system designated by system manufacturer as hardener, sealer, densifier.
 - 1. Basis of Design: Nox-Crete Products Group/Duro-Nox LS.
 - 2. Basis of Design: W. R. Meadows, Inc./Liqui-Hard Ultra.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Ensure surfaces to receive hardener sealer are clean and well cured.
- B. Do not commence work until surface conditions are within tolerances required for proper finishing based on manufacturer recommendations.
- C. Start of work indicates acceptance of conditions.

3.2 PREPARATION

- A. Clean concrete slab free from foreign matter and prepare concrete for sealing in accordance with system manufacturer recommendations.

3.3 INSTALLATION

- A. Comply with curing, hardener, sealer manufacturer recommendations and application instructions for application of concrete hardener sealer densifier as required to match approved samples and mock-up.

3.4 PROTECTION

- A. Comply with system manufacturer recommendations for protecting floors until ready for use. Keep surface dry for minimum 48 hours after application.

- B. Do not permit traffic on floors with curing, hardener, sealer for at least 72 hours.
- C. Protect floors with curing, hardener, sealer until Substantial Completion.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Structural steel framing members and support members.
- B. Baseplates, and anchor bolts.
- C. Grouting under baseplates.

1.2 REFERENCES

- A. CBC – California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 19.
- B. ASTM A36 – Carbon Structural Steel
- C. ASTM A53 – Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
- D. ASTM A108 – Steel Bars, Carbon, Cold-Finished, Standard Quality
- E. ASTM A307 – Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
- F. ASTM A325 – High Strength Bolts for Structural Steel Joints
- G. ASTM A490 – Structural bolts, alloy steel, heat treated, 150 ksi minimum tensile strength
- H. ASTM A500 – Cold-formed welded and seamless carbon steel structural tubing in round and shapes
- I. ASTM A992 – Standard specification for steel for structural shapes for use in building framing
- J. ASTM C1107 – Packaged dry, hydraulic cement grout (non shrink)
- K. ASTM F1554 – Standard specification for anchor bolts, steel, 36, 55, and 105 ksi yield strength
- L. AWS A2.4 – Standard welding symbols
- M. AWS D1.1 – Structural welding code - steel
- N. ANSI / ASCE 360 – Specification for the design, fabrication, and erection of structural steel for buildings
- P. SSPC – The society for Protective Coatings

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00: Submittal Procedures.
- B. Shop Drawings:
 - 1. Indicate profiles, sizes, spacing, and locations of structural members, connections, cambers and loads.
 - 2. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Manufacturer's mill certificate: submit under provisions of section 01 33 00 certifying that products meet or exceed specified requirements.

- D. Mill test reports: Submit under provisions of section 01 33 00 Manufacturer's certificates, indicating structural strength and destructive and non-destructive test analysis.
- E. Welders' certificates: Submit under provisions of section 01 33 00, certifying welders employed on the work, verifying AWS qualification within the previous 12 months.
- F. Architectural exposed structural steel: submit under provisions of section 01 33 00.

1.4 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC-specification for the design, fabrication and erection of structural steel for buildings.

1.5 QUALIFICATIONS

- A. Design connections not details on the drawings under direct supervision of a professional structural engineer experienced in design of this work and licensed in the state of California.
- B. Design connections in accordance with CBC California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 22.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Structural steel members: ASTM A36
- B. W and WT shapes: ASTM A992
- C. Structural tubing: ASTM A500, Grade B
- D. Steel pipe: ASTM A53, Grade B
- E. Shear stud connectors: ASTM A108, Grade 1015, forged steel, headed, unfinished
- F. Threaded bolts: ASTM A36 (typical); ASTM F1554 (at concrete/masonry)
- G. Anchor bolts: ASTM A307 (typical); ASTM F1554 (at concrete/masonry)
- H. Nuts: ASTM A563
- I. Washers: ASTM F436
- J. Welding materials: AWS D1.1; type required for materials being welded
- K. Grout: ASTM C1107, non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 28 days.

2.2 FABRICATION

- A. Fabricate structural steel members in accordance with AISC Specification.
- B. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

2.3 FINISH

- A. Prepare structural component surfaces in accordance with SSPC SP-2.
- B. Shop and touch-up primer: SSPC 15, Type 1, Red Oxide.
- C. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded or in contact with concrete or masonry.

- D. Finish: Site paint exposed to view structural steel members under provisions of Section 09 90 00.

2.4 SOURCE QUALITY CONTROL AND TESTS

- A. Testing and analysis of components will be performed under provisions of Section 01 45 29.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means erector accepts existing conditions.

3.2 ERECTION

- A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- B. Field weld components indicated on drawings.
- C. Field connect members with threaded fasteners indicated; torque to required resistance.
- D. Do not field cut or alter structural members without approval of architect.
- E. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.3 GROUTING

- A. Clean concrete on masonry bearing surfaces.
- B. Roughen bearing surface prior to setting base and bearing plates.
- C. Set base and bearing plates on wedges, shims, or setting nuts.
- D. Tighten anchor bolts after members are positioned and plumb.
- E. Cut off protruding wedges or shims flush with edge of base or bearing plate.
- F. Pack grout solidly between bearing surfaces and plates so no voids remain.
- G. Finish exposed surfaces, protect installed materials, and allow to cure.

3.4 ERECTION TOLERANCES

- A. Erect structural steel members in accordance with AISC Specification.

3.5 RECYCLING CONSTRUCTION WASTE

- A. Recycle excess materials waste under the provisions of Section 01 74 19.

3.6 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 29.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide stock and custom fabricated metal items scheduled at end of this Section, complete in respect to function as intended.
 - 1. Metal fabrications includes items made from iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of structural steel or metal systems specified elsewhere.
- B. Related Sections:
 - 1. Section 32 31 20: Decorative metal fences and gates.

1.2 REFERENCES

- A. American Welding Society (AWS): D1.1, Structural Welding Code.
- B. National Association of Architectural Metal Manufacturers (NAAMM): Pipe Rail Manual.
- C. National Association of Architectural Metal Manufacturers (NAAMM):
 - 1. Pipe Rail Manual.
 - 2. Heavy Duty Metal Bar Grating Manual.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's literature for products used in metal fabrications, including paint, grout and manufactured items.
- B. Shop Drawings: Submit for fabrication and erection of metal fabrications. Indicate profiles, sizes, connection, reinforcing and anchorage.
 - 1. Provide templates for anchorage installation by others.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Description: Provide stock and custom fabricated metal items.
- B. Steel Shapes, Plates and Bars: ASTM A36.
 - 1. Steel Bar Grating: ASTM A36 or ASTM A1011.
 - 2. Wrought Iron: Maximum 0.3% carbon content with slag mechanically mixed with iron and conforming to ASTM E350 analysis; soft, ductile, and corrosion resistant.

- C. Structural Steel Sheet: Hot rolled, ASTM A1011; or cold rolled, ASTM A1008, Class 1; of grade required for design loading.
- D. Steel Pipe: ASTM A53, Type S seamless, grade as selected by fabricator and as required for design loading; minimum standard weight, STD or Schedule 40.
- E. Steel Tubing: Cold formed ASTM A500; or hot rolled, ASTM A501; minimum Grade B; seamless where exposed.
- F. Castings: Gray iron, ASTM A48, Class 30; malleable iron, ASTM A47.
- G. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron ASTM A47, or cast steel ASTM A27. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM A153.
- H. Grout: Non-shrink meeting ASTM C1107, non-metallic, pre-mixed, factory-packaged, non-staining, non-corrosive; type specifically recommended by manufacturer as applicable to job condition.
- I. Fasteners and Rough Hardware: Type required for specific usage; provide zinc-coated fasteners for exterior use or where built into exterior walls.
- J. Welding Materials: AWS D1.1, type required for materials being welded.
- K. Paint: Provide primers as recommended by paint manufacturers for substrates and paints specified in Section 09 90 00 – Painting and Coating.
 - 1. Galvanizing Repair Paint: High zinc-dust content paint for regalvanizing welds in galvanized steel.

2.2 FABRICATION

- A. Fabricate items with joints neatly fitted and properly secured.
- B. Grind exposed welds continuous, smooth and flush with adjacent finished surfaces, and ease exposed edges to approximate 1/32" uniform radius.
- C. Exposed Mechanical Fastenings: Flush countersunk fasteners unobtrusively located, consistent with design of structure.
- D. Fit and shop assemble in largest practical sections for delivery.
- E. Make exposed joints flush butt type, hairline joints where mechanically fastened.
 - 1. Fabricate joints exposed to weather in manner to exclude water or provide weep holes where water could accumulate.
- F. Supply components required for proper anchorage of metal fabrications; fabricate anchorage and related components of same material and finish as metal fabrication.

- G. Railings: Comply with California and ADA Standards access requirements and NAAMM "Pipe Railing Manual"; welded construction; cap exposed ends.
 - 1. Railing Design Requirements: Design railings to support a lateral force of 50 lbs. /lin. ft. uniform load and 200 lbs. at any single point without permanent set or damage; ASTM E935.
 - a. Top Rails: Design to support minimum 300 lb. concentrated single point load applied at any point vertically or horizontally.
 - 2. Regulatory Requirements:
 - a. Access: Comply with California Building Standards Code and Americans with Disabilities Act (ADA) Standards for access for persons with disabilities.
 - b. Code: Comply with requirements of applicable codes for railing design, except where more restrictive codes are specified.
 - 3. Handrails: Seamless steel tube rails, 1-1/2" outside diameter, continuous railings conforming to applicable code and design requirements.
 - 4. Wall Rail Brackets: Castings as approved by Architect.
 - 5. Wall Returns: 90° elbow return with 1/4" maximum clearance unless otherwise indicated.
 - a. Provide wall plates only where indicated and where required by applicable codes.
- H. Ladders: Comply with requirements of ANSI A14.3 and Cal/OSHA; Contractor option steel or aluminum.
 - 1. Rungs: Fit in centerline of side rails, plug weld and grind smooth on outer rail faces; provide non-slip surface on top of rung, similar to epoxy resin and aluminum oxide granules surface.
 - 2. Ladder Extensions: Provide 48" ladder extension device for fixed ladders under access hatches and floor doors.
 - a. Manufacturers:
 - 1) Bilco/LadderUP Safety Post.
 - 2) O'Keeffe's/Safety Post Model SP400.
 - 3) Precision Ladder/Extend-A-Rail.
 - 4) Substitutions: Refer to Section 01 25 00.
 - 3. Personal Fall Arrest Systems: Provide system on ladder designed to stop a fall before person contacts a lower level where required for specific ladder applications; system to be acceptable to authorities having jurisdiction.
 - 4. Ladder Security Doors: Nominal 18 gage (0.05") thick metal plate with piano hinge and hasp and staple for Owner furnished padlock; not less than full ladder width, between vertical rails, and 8'-0" high.

- I. Steel Bollards: Minimum Schedule 80 seamless steel piping, filled with minimum 2000 psi concrete.
 - 1. Removable Bollards: As indicated; provide steel piping without concrete fill, fitted with hasp and eye to allow for Owner furnished padlocks to prevent unauthorized removal; cap top end of pipe with flush, welded end cap; bottom open.

- J. Fall Protection Roof Eye Bolts: Provide roof tie backs conforming to Title 8, California Code of Regulations, Section 3191(f) for tie-backs for fall protection where applicable.
 - 1. Type: 2" closed eye drop forged hot-dipped galvanized eye bolts, 12'-0" on center.
 - 2. Strength: Set to withstand minimum 5400 lb. tensile load.
 - a. .

- K. Finishes: Galvanize and prime paint exterior work and prime paint interior work unless otherwise noted in Schedule; comply with requirements of Section 09 90 00 - Painting and Coating for preparation and priming.
 - 1. Thoroughly clean surfaces of rust, scale, grease and foreign matter prior to applying finish.
 - 2. Do not shop prime surfaces in contact with concrete or requiring field welding; shop prime in one coat.
 - 3. Galvanized Coating: Provide coating comparable to ASTM A924 and A653, minimum G90 hot dip galvanized coating.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible; do not delay job progress; allow for trimming and fitting where necessary.

3.2 ERECTION

- A. Obtain Architect's review prior to site cutting and adjusting which are not part of scheduled work.
 - 1. Perform necessary cutting and altering for installation and coordination with other work.

- B. Install items square and level, accurately fitted and free from distortion or defects detrimental to appearance or performance.
 - 1. Supply items required to be cast into or embedded in other materials to appropriate trades.

2. Ensure alignment with adjacent construction; coordinate with related work to ensure no interruption in installation.
- C. Make provision for erection stresses by temporary bracing; keep work in alignment.
- D. Field bolt and weld to match standard of shop bolting and welding; hide bolts and screws whenever possible, where not hidden, use flush countersunk fastenings.
 1. Perform field welding in accordance with AWS D1.1.
- E. After installation, touch-up field welds and scratched and damaged surfaces; use primer consistent with shop coat or recommended for galvanized surfaces, as applicable.
- F. Replace items damaged in course of installation and construction.

3.3 SCHEDULE

- A. Supply and install metal fabrications listed in Schedule, complete with anchorage and attachments necessary for installation.
 1. Schedule lists principal items only, refer to Drawings for items not listed.
- B. Schedule:
 1. Miscellaneous angles, plates and attachments to be set in concrete or masonry for anchorage of other items.
 2. Iron and steel shapes, sleeves, anchors, connectors and fastenings required to complete construction work, and which are not provided in other Specification sections.
 - a. Rough hardware, including bolts, fabricated plates, anchors, hangers, dowels and miscellaneous metals.
 - b. Ledge and shelf angles, channels and plates not attached to structural steel, and for support of metal decking.
 - c. Beams of structural shapes not supported by structural steel.
 3. Ladders.
 4. Steel bollards.
 5. Roof eye bolts.

END OF SECTION

SECTION 05 70 00

DECORATIVE METAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide decorative (ornamental) metal items including attachment
 - 1. Provide custom aluminum canopies.
- B. Related Work:
 - 1. Section 05 50 00: Metal fabrications including steel railings.
 - 2. Section 32 31 20: Decorative metal fences and gates.

1.2 REFERENCES

- A. National Association of Architectural Metal Manufacturers: Metal Finishes Manual.
- B. Builders Hardware Manufacturers Association (BHMA): BHMA 1301/ ANSI A156.18 Standard for Materials and Finishes.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Design/Build: Provide special engineering to ensure compliance with applicable codes and Contract Documents.
- B. Pre-Installation Meeting: Convene not less than one week prior to commencing work of this Section. Require attendance of those directly affecting work of this Section.
 - 1. Review installation procedures and coordination required with related work.

1.4 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature including recommendations for cleaning.
- B. Shop Drawings: Show detailing including anchorage, accessories, and supporting members.
- C. Samples: Furnish samples of each exposed metal finish.
- D. Design/Build Certificates: Submit engineer certification by California licensed structural engineer indicating decorative metal complies with Contract Documents and applicable code requirements.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm with minimum five years successful experience fabricating decorative metal items like those required for Project.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Description: Provide decorative (ornamental) metal items specified including attachment devices and accessories.
- B. Aluminum: Provide alloy and temper recommended by aluminum producer or finisher for type and use and finish indicated; sized for strength and durability consistent with application involved.
 - 1. Materials: Comply with following minimum standards for aluminum.
 - a. Extruded Bar and Shapes: ASTM B221, 6063-T6.
 - b. Extruded Pipe and Tube: ASTM B429, 6063-T6.
 - c. Drawn Seamless Tube: ASTM B483, 6063-T832.
 - d. Plate and Sheet: ASTM B209, 6061-T6.
 - e. Die and Hand Forgings: ASTM B247, 6061-T6.
 - f. Castings: ASTM B26, 356.0-T6.
 - 2. Finish: Comply with following finishes as designated by NAAMM "Metal Finishes Manual" and referenced standards.
 - a. Thermal Setting Organic Coating Finish: AA-C21C42R1x, 1.5 mil organic coating; AAMA 603.8.
 - 1) Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
 - b. High Performance Organic Coating Finish: AA-C12C42R1x, prepared, pretreated, and coated with minimum two coat Kynar 500 or Hylar 5000 system; AAMA 2605.
 - 1) Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
 - c. High Performance Organic Coating Finish: AA-C12C42R1x, prepared, pretreated, and coated with minimum two-coat system; AAMA 2605.
 - 1) PVDF Manufacturers:
 - a) Arkema Group/Kynar 500.
 - b) Solvay Solexis/Hylar 5000.
 - c) Substitutions: Refer to Section 01 25 00.
 - 2) Paint Manufacturers:
 - a) PPG Industries.
 - b) Valspar Corp.
 - c) Akzo Nobel.
 - d) Substitutions: Refer to Section 01 25 00.

- 3) Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect including metallic colors with mica chips.

C. Decorative Iron and Steel:

1. Steel Shapes, Plates and Bars: ASTM A36.
2. Steel Sheet: Hot rolled, ASTM A1011; or cold rolled, ASTM A1008, Class 1; of grade required for design loading.
3. Steel Pipe: ASTM A53, Type S seamless, grade as selected by fabricator and as required for design loading; minimum standard weight, STD or Schedule 40.
4. Steel Tubing: Cold formed ASTM A500; or hot rolled, ASTM A501; minimum Grade B; seamless where exposed.
5. Castings: Gray iron, ASTM A48, Class 30; malleable iron, ASTM A47.
6. Decorative Steel Paint: Provide primers as recommended by paint manufacturers for substrates and paints specified in Section 09 90 00 – Painting and Coating.
 - a. Galvanizing Repair Paint: High zinc-dust content paint for repair of welds in galvanized steel.
7. Blackened Steel Finish: Provide black oxide finish using passivation process to protect steel from rust by forming magnetite on exposed steel surfaces using traditional caustic process of alkali salt solution at elevated temperatures.
 - a. Clear Coating: Provide premium quality polyurethane or acrylic urethane coating for durable protective coating of blackened steel; prepare steel and apply coating in accordance with coating manufacturer recommendations.
 - b. Final Appearance: As approved by Architect; match Architect's sample.
8. Decorative Steel Shop Finish: Provide TGIC powder coat finish over galvanized coating.
 - a. Manufacturers:
 - 1) Courtaulds Coatings (Interpon)/TGIC Powder Coating.
 - 2) Porter Powder Coatings/TGIC Powder Coating.
 - 3) H.B. Fuller Co./TGIC Powder Coating.
 - 4) Fuller O'Brien/TGIC Powder Coating.
 - 5) Substitutions: Refer to Section 01 25 00.
 - b. Powder Coating System: Provide top line quality commercial grade factory formulated polyester TGIC powder coating materials intended for powder coating application and as required to match approved sample.
 - c. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.

- D. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron ASTM A47, or cast steel ASTM A27.
 - 1. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM A153.
- E. Grout: Non-shrink meeting ASTM C1107, non-metallic, pre-mixed, factory-packaged, non-staining, non-corrosive; type specifically recommended by manufacturer as applicable to job condition.
 - 1. Manufactures:
 - a. Master Builders/Masterflow 713.
 - b. Five Star Products, Inc./Five Star Grout.
 - c. Bostik Construction Products/Upcon Grout.
 - d. Protex Industries, Inc./Propak.
 - e. Substitutions: Refer to Section 01 25 00.
- F. Brackets and Anchors: Unexposed plates, angles and supports may be steel; exposed items to match decorative metal type and finish.
- G. Fasteners: Type required for specific usage; provide concealed fasteners except where specifically approved; where exposed match type and finish of metal being fastened.
 - 1. Concealed Steel Fasteners: Hot-dipped galvanized minimum G90 where built into exterior walls or subject to high humidity.

2.2 FABRICATION

- A. Decorative Steel Field Finishes: Galvanize and prime paint exterior work and prime paint interior work unless otherwise noted in Schedule; comply with requirements of Section 09 90 00 - Painting and Coating for preparation and priming.
 - 1. Thoroughly clean surfaces of rust, scale, grease and foreign matter prior to applying finish.
 - 2. Do not shop prime surfaces in contact with concrete or requiring field welding; shop prime in one coat.
 - 3. Galvanized Coating: Provide coating comparable to ASTM A924 and A653, minimum G90 hot dip galvanized coating.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible; do not delay job progress; allow for trimming and fitting where necessary.

3.2 INSTALLATION

- A. Install decorative metal items in accordance with manufacturer's recommendations, installation instructions, and approved shop drawings.
- B. Install plumb, true and in correct relation to adjacent work, free from distortion or defects detrimental to appearance and performance.
- C. Prior to securing continuous items, adjust to ensure proper matching at butt joints and correct alignment throughout their length.
- D. Tolerances: Accurately align and locate components to column lines and floor levels; adjust work to conform to following tolerances.
 - 1. Plumb: 1/8" in 10'-0"; 1/4" in 40'-0"; non-cumulative.
 - 2. Level: 1/8" in 20'-0"; 1/4" in 40'-0"; non-cumulative.
 - 3. Alignment: Limit offset to 1/16" where surfaces are flush or less than 1/2" out of flush and separated by less than 2" (by reveal or protruding work); otherwise limit offsets to 1/8".
 - 4. Location: 3/8" maximum deviation from measured theoretical location (any member, and location).
- E. Install anchorage devices to securely and rigidly fasten system to building.
- F. Provide anchors to be installed in other work, and setting details, in time for proper installation by trades concerned; verify correct placement.

3.3 CLEANING

- A. Clean decorative metal surfaces promptly after installation of components, exercising care to avoid damage of finish.
- B. Remove excess sealant compounds, dirt and other foreign substances.

3.4 PROTECTION

- A. Repair or replace items damaged or marred during construction.

END OF SECTION

SECTION 06 10 53

MISCELLANEOUS ROUGH CARPENTRY

1.1 PART 1 - GENERAL

A. WORK INCLUDED

1. Roof curbs and cants.
2. Blocking in wall and roof openings.
3. Wood furring and grounds.
4. Wood treatment.

B. REFERENCES

1. APA - American Plywood Association.
2. AWWPA - American Wood Preservers Association: Treating Practices.
3. RIS - Redwood Inspection Service: Standard Specifications for Grades of California Redwood Lumber.
4. WCLIB - West Coast Lumber Inspection Bureau: Standard Grading Rules for West Coast Lumber.
5. WWPA - Western Wood Products Association.

C. SUBMITTALS

1. Submit certificate based on actual moisture content readings performed in accordance with this Section, indicating moisture content of all lumber was 19 percent or less at time of installation.

D. QUALITY ASSURANCE

1. Lumber Grading Agency: Certified by specified agency and approved by Division of State Architect.
2. Plywood Grading Agency: Certified by specified agency.
3. Provide Certificate of Inspection or grade mark by an approved inspection agency on each piece of lumber and plywood, indicating compliance with applicable standards or grading rules specified in the referenced standards and this Section.
4. Provide quality mark by an approved inspection agency on each piece of preservative- treated lumber and plywood, indicating compliance with applicable standards or grading rules specified in the referenced standards and this Section.

E. DELIVERY, STORAGE AND HANDLING

1. Store materials on site in a area protected from potential damage. Provide loose opaque covers or other protection from sun and rain.

2. Store on skids or other elevated supports.

1.2 PART 2 - PRODUCTS

A. LUMBER MATERIALS

1. Lumber Grading Rules: APA, NFOPA, RIS, WCLIB, and WWPA.
 - a. Lumber Materials: Comply with Chapter 23, Part 2, Title 24.
2. Wood blocking: Provide Douglas Fir No.2 grade for use as blocking, nailers, and similar applications.
 - a. *Use pressure treated wood at all roof applications.*
 - b. *Use fire retardant treated wood for rated roofing applications.*

B. PLYWOOD MATERIALS

1. Sheathing:
 - a. APA rated in accordance with PS 1-09.
 - b. Roof Sheathing: Unless noted otherwise on structural drawings, Structural I Rated Sheathing, minimum Span Rating 32/16, 5 ply, face veneer C-D, Exposure 1, Conventional Type.
 - 1) *Provide fire retardant/preservative treatment at plywood conditions where required by jurisdictional authority.*

C. ACCESSORIES

1. Fasteners:
 - a. Common nails complying with Chapter 23, Part 2, Title 24, CCR, size as required to suit condition, as specified.
 - b. Screws: Stainless steel, minimum # 10 screw, length and type as required for fastening.
 - c. Provide hot dip galvanized steel fasteners at the following applications:
 - 1) Exterior framing exposed to weather.
 - 2) Framing of preservative treated lumber.
 - d. Box nails or "sinkers" are not permitted.
2. Framing Connectors:
 - a. Connector references, unless noted otherwise, are based on products as defined in the latest edition of the Simpson Strong-Tie catalog.
 - b. Use only fasteners as approved for listed connector. Where more than one type of fastener in the referenced series is scheduled, provide fastener with greatest capacity.

3. Bolts:

- a. Bolts: A 307, machine bolts, size and type as indicated, with washers under head and nut. Provide hot dipped galvanized at all conditions defined above for nail fasteners.
- b. Lag Bolts: A 307, cut thread, size and type as indicated, with washers under head. Provide hot dipped galvanized at all conditions defined above for nail fasteners.

D. PRESERVATIVE TREATMENT

- 1. Wood Preservative (Site Application): Water based material system as recommended by AWWA for repair of treated surfaces.
- 2. Wood Preservative (Pressure Treatment):
 - a. Wood shall bear WCPA or WCLIB grading stamp and the AWWA Quality mark. AWWA mark shall designate treatment method, retention value and KDAT (kiln dried after treatment).
 - b. Comply with Section 2303.1.9, Chapter 23, Part 2, Title 24, CCR.
 - c. AWWA Treatment U-1, Commodity Specification A using water borne preservative.
 - d. Moisture Content: Kiln Dry all materials after treatment to 19 percent maximum moisture content.

E. FIRE RETARDANT TREATMENT

- 1. *Manufacturer: Hoover or equal.*
- 2. *Treatment Series: Exterior Fire-X*
- 3. *Ratings:*
 - a. *Flame Spread: Maximum flame spread of 25 per ASTM E 84.*
 - b. *Flame Spread Reduction: No reduction in flame spread rating after accelerated weathering test in accordance with ASTM D 2898.*
 - c. *Labeling: Underwriters Laboratory Listed and Labeled.*

F. OTHER MATERIALS

- 1. Provide all other materials, not specifically described but required for complete and proper installation of this work, as selected by the Contractor and subject to the approval of the Architect.

1.3 PART 3 - EXECUTION

A. SURFACE CONDITIONS

- 1. Inspection

- a. Prior to work of this Section, carefully inspect previously installed work. Verify all such work is complete to the point where this installation may properly commence.
- b. Verify that work of this Section may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.
- c. In the event of discrepancy, immediately notify the Architect.
- d. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

B. SITE APPLIED WOOD TREATMENT

1. Brush apply two coats of specified preservative treatment to cut ends, holes, daps, notches, and similar field cuts of pressure treated wood in accordance with AWWPA standards.
2. Allow preservative to cure prior to erecting members.

C. FRAMING

1. Lumber Selection:
 - a. Select individual pieces so that knots and obvious minor defects will not interfere with connection. Install all members with crown and tight knots in the upper position.
 - b. Do not use lumber with end splits or checks greater than the following:
 - 1) 2 x joists: Split length shall be less than or equal to one half the wide face of the member.
 - 2) Beams or headers: Split length shall be less than or equal to the thickness of the member.
2. Erect wood framing members level and plumb. Place horizontal members laid flat, crown side-up.
3. Construct framing members full length without splices.
4. Predrill holes for nails when necessary to prevent splitting, maximum hole size not more than 0.90 times nail diameter.
5. Drill holes for threaded fasteners as follows:
 - a. Wood Screws larger than # 14: Drill lead holes for shank and threaded portion to 7/8 times shank and thread root diameter, respectively.
 - b. Lag screws: Drill lead hole same diameter and depth as shank; drill hole for threaded portion to 0.7 times shank diameter.
 - c. Bolts: Oversize hole by not more than 1/16 inch.
6. Re-tighten all threaded fasteners before covering-up.

7. Cutting:
 - a. Provide all cutting of framing members to accommodate structural members, piping, conduit, ducts, and building system equipment and fixtures.
8. Framing for Connectors
 - a. Where roofing, plaster or other finish occurs, all straps, seats, bolts, and nuts which occur on the exposed exterior face of beams or posts shall be "let-in," dapped or countersunk to be flush with the face of the member.
 - b. Verify amount and method with Architect prior to proceeding.
 - c. Install wood stripping or blocking where indicated on the drawings or required at right angles to supported members and securely nail into place. Space as indicated. Align and level stripping by shimming where necessary. Provide stripping or blocking to conceal all plumbing, conduit, and other items shown installed in framing, whether such stripping is shown or not.

D. PLYWOOD SHEATHING BACKING

1. Secure sheathing edges over firm bearing with specified stainless steel screws. Provide solid blocking at all sheathing edges.
 - a. Provide 1/8 inch spacing between panel edges.

E. TOLERANCES

1. Location: 1/4 inch maximum from true position.

END OF SECTION

SECTION 06 11 00

WOOD FRAMING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Structural wall and roof framing.
- B. Wall and roof sheathing.
- C. Roof curbs and cants.
- D. Blocking in wall and roof openings.
- E. Wood furring and grounds.
- F. Concealed wood blocking for support of washroom accessories, wall cabinets, and equipment.
- G. Wood treatment.

1.2 REFERENCES

- A. California Building Code (CBC) 2022 edition.
- B. APA - American Plywood Association.
- C. AWPA – M-4 Standard for the Care of Preservative Treated Wood Products.
- D. AWPA – U1 – Use Category System – User Identification for Treated Wood.
- E. WCLIB - West Coast Lumber Inspection Bureau: Standard Grading Rules No. 17.
- F. WWPA - Western Wood Products Association: Standard Grading Rules.
- G. ALSC - American Lumber Standards Committee: Softwood Lumber Standards.
- H. ANSI/AF & PA NDS-18 - National Design Specifications for Wood Construction.
- I. ANSI/SDPWS - Special Design Provisions for Wind and Seismic.
- J. ASTM D6109 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastic Lumber.
- K. ASTM E84 - Standard Test Method for Surface burning Characteristics of Building Materials.
- L. FSC – Forest Stewardship Council.
- M. MS MIL-L-19140 - Fire Retardant Wood Preservative Chemicals.
- N. National Bureau of Standards - Product Standard PS-1-09 for Construction and Industrial Plywood.

1.3 SUBMITTALS

- A. Submit certificate from pressure treatment facility indicating "the wood is free of visible arsenical surface deposits" following treatment.
- B. Submit certificate based on actual moisture content readings performed in accordance with this Section, indicating moisture content of all lumber was 19 percent or less at time of installation.

1.4 QUALITY ASSURANCE

- A. Lumber Grading Agency: Certified by specified agency and approved by Division of State Architect.
- B. Plywood Grading Agency: Certified by specified agency and approved by Division of State Architect.
- C. Provide Certificate of Inspection or grade mark by an approved inspection agency on each piece of lumber and plywood, indicating compliance with applicable standards or grading rules specified in the referenced standards and this Section.
- D. Provide quality mark by an approved inspection agency on each piece of preservative- treated lumber and plywood, indicating compliance with applicable standards or grading rules specified in the referenced standards and this Section.
- E. Provide on-site or other approved quality control program acceptable to Architect and designed to test lumber materials prior to installation in order to demonstrate compliance with moisture content criteria.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials on site in a area protected from potential damage. Provide loose opaque covers or other protection from sun and rain.
- B. Store on skids or other elevated supports.
- C. Pile and strip lumber to insure free air circulation. Allow lumber to season as required to achieve specified moisture content prior to installation in building.
- D. Prior to beginning installation, all lumber used shall have a maximum moisture content of 19 percent, unless noted otherwise. Provide written certification, based on moisture meter tests, of compliance acceptable to Owners inspector and Architect.
- E. Prior to finish system installation, protect all sheathing with temporary coverings as required to prevent delamination and splitting.

2 PART 2 - PRODUCTS

2.1 LUMBER MATERIALS

- A. Lumber Grading Rules: WCLIB, and WWPA.
 - 1. Lumber Materials: Comply with Chapter 23, Part 2, Title 24, CCR.

2. Plywood Sheathing Materials: Comply with requirements of Section 2303, Chapter 23, Part 2, Title 24, CCR.
- B. *Use fire retardant treated wood and plywood as specified in this Section for roof curb and blocking applications.*
- C. Beams and Stringers, 5 inches and thicker, with width more than 1 inch greater than thickness size classification:
 1. Species: Douglas Fir-Larch.
 2. Grade: Unless specified otherwise, No. 1.
 - Provide Select Structural grade at all exposed applications, selected for appearance and straightness.
 3. Surfacing: S4S.
 4. Moisture Content: 19 percent maximum moisture content at time of installation.
 5. Where size permits, provide Free of Heart Center lumber at all exposed applications.
- D. Roof, ceiling and floor joist, 2 to 4 inch thick, 6 inches and wider size classifications:
 1. Species: Douglas Fir-Larch.
 2. Grade: Unless specified otherwise, No. 1 and Better.
 - Provide Select Structural grade at all exposed exterior applications, selected for appearance and straightness.
 3. Surfacing: S4S.
 4. Moisture Content: 19 percent maximum, at time of installation.
 - Provide 15 percent maximum moisture content at vaulted and sloped roof framing members and at all floor framing members at time of installation.
- E. Studs and blocking, 2 to 4 inches thick, 6 inches and wider respectively, all plate stock not in contact with concrete, and all structural light framing size classifications:
 1. Species: Douglas Fir-Larch.
 2. Grade: Unless specified otherwise, No. 1 and Better. (No.2 for Studs and blocking 2 to 4 inches thick, 2 to 4 inches wide)
 - Limit warp to 1/2 of Medium.
 - Provide Select Structural grade at all exposed applications, selected for appearance and straightness.

3. Surfacing: S4S.
 4. Moisture Content: 19 percent maximum, at time of installation.
- F. Posts and Timber 5 x 5 inches and larger, width not more than 2 inch greater than thickness:
1. Species: Douglas Fir-Larch.
 2. Grade: No. 1.
 - Provide Select Structural grade at all exposed applications, selected for appearance and straightness.
 3. Surfacing: S4S.
 4. Moisture Content: 19 percent maximum, at time of installation.
 5. Where size permits, provide Free of Heart Center lumber at all exterior applications.
- G. Sills and Plates in Contact with Concrete and concrete topping: Douglas Fir-Larch species, #2 or better, S4S, pressure treated in accordance with this Section.
- H. Miscellaneous non-load carrying members: Douglas Fir-Larch species, #1 or better grade, S4S, 19 percent moisture content at time of installation.
- I. Roof blocking: Provide Douglas Fir-Larch, No.2 and Better, grade for use as blocking, nailers, and similar applications in contact with roofing materials or flashings.
- J. Use pressure treated wood as specified in this Section for locations in contact with concrete, concrete topping, masonry and for foundation conditions.
- K. *Use fire retardant treated wood and plywood as specified in this Section for interior corridor applications.*

2.2 PLYWOOD MATERIALS

- A. Sheathing:
1. APA rated in accordance with PS 1.
 2. Roof Sheathing: Unless noted otherwise, Structural I Rated Sheathing, minimum Span Rating 32/16, 5 ply, face veneer C-D, Exposure 1, Conventional Type.
 - Provide 1-1/8 inch thick APA 303-OL siding, minimum Span Rating 32/16, minimum 5 ply, MDO overlay, Exposure 1, Conventional Type. Install with MDO surface face down at all exposed walkway trellis conditions.

- *Sheathing at Fluid Applied Traffic Topping: Unless noted otherwise, Structural I Rated Sheathing, minimum Span Rating 32/16, 5 ply, face veneer AC, Exposure 1, Conventional Type.*
- 3. Wall Shear Panels: Unless noted otherwise, Structural I Rated Sheathing, minimum Span Rating 32/16, face C-C, Exposure 1, Group 1 species.
- 4. Floor Sheathing: Unless noted otherwise, Structural I Rated Sheathing, APA Rated Sheathing, Exposure 1, square edge, Group 1 species, C-D veneers, thickness as shown on drawings.
 - Provide APA Sturd-i-flor, T and G edge, touch sanded B face veneer at resilient and seamless flooring applications.
 - Provide Exterior exposure durability classification at floor sheathing receiving seamless flooring and at all exterior landings and ramps.
 - Provide preservative treatment at plywood conditions where required by jurisdictional authority.

2.3 ACCESSORIES

A. Nail Fasteners:

1. Common nails complying with Section 2304.10, Chapter 23, Part 2, Title 24, CCR, size as required to suit condition and as specified.
2. Provide hot dip galvanized fasteners at the following applications:
 - Exterior framing exposed to weather.
 - Framing of preservative treated lumber.
 - Interior framing in high humidity areas, such as commercial kitchens and locker rooms.
3. Box nails or "sinkers" are not permitted.
4. Where specified, provide ring shank or screw nails complying with minimum common nail requirements of Table 2304.10.1, Chapter 23, Part 2, Title 24, CCR, at roof and floor plywood sheathing.

B. Framing Connectors:

1. Connector references, unless noted otherwise, are based on products as defined in the latest edition of the Simpson Strong-Tie catalog.
 - USP and KC Metals, with equal configuration, structural values and jurisdictional authority approval are approved equals.
2. Alternate connectors submitted to the Architect for consideration as approved equal shall have equivalent ICC Report Number ratings.

3. Use only fasteners as approved for listed connector. Where more than one type of fastener in the referenced series is scheduled, provide fastener with greatest capacity.

C. Bolts:

1. Bolts: ASTM A 307, machine bolts, size and type as indicated, with washers under head and nut. Provide hot dipped galvanized at all conditions defined above for nail fasteners.
2. Lag Bolts: ASTM A 307, cut thread, size and type as indicated, with washers under head. Provide hot dipped galvanized at all conditions defined above for nail fasteners.

D. Non-Shrink Grout: As specified in Section 03 30 10.

E. Dry-pack Grout: Type 2 Portland cement grout, ratio of 1.0 part cement to 3.0 parts sand, by volume, with only enough water to assure placement and hydration.

2.4 WOOD TREATMENT

A. Wood Preservative (Site Application): Water based material system as recommended by AWPA for repair of treated surfaces.

B. Wood Preservative (Pressure Treatment):

1. Wood shall bear WWPA or WCLIB grading stamp and the AWPA Quality mark. AWPA mark shall designate treatment method, retention value and KDAT (kiln dried after treatment).
2. Comply with Section 2303.1.9, Chapter 23, Part 2, Title 24, CCR, except that CCA treatments are not acceptable for conditions exposed to view in the completed project from any point.
3. Above Ground Application: AWPA Treatment UC2, Section 4, using water borne preservative.
4. Ground Contact Application: AWPA Treatment UC-4A using water borne preservative.
5. Moisture Content: Kiln Dry all materials after treatment to 19 percent maximum moisture content.

2.5 FIRE RETARDANT TREATMENT

A. *Manufacturer: Hoover or equal.*

B. *Treatment Series: Exterior Fire-X*

C. *Ratings:*

1. *Flame Spread: Maximum flame spread of 25 per ASTM E 84.*
2. *Flame Spread Reduction: No reduction in flame spread rating after accelerated weathering test in accordance with ASTM D 2898.*

3. *Labeling: Underwriters Laboratory Listed and Labeled.*

2.6 OTHER MATERIALS

- A. Provide all other materials, not specifically described but required for complete and proper installation of this work, as selected by the Contractor and subject to the approval of the Architect.

3 PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection
 - 1. Prior to work of this Section, carefully inspect previously installed work. Verify all such work is complete to the point where this installation may properly commence.
 - 2. Verify that work of this Section may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.
 - 3. In the event of discrepancy, immediately notify the Architect.
 - 4. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 SITE APPLIED WOOD TREATMENT

- A. Brush apply two coats of specified preservative treatment to cut ends, holes, daps, notches, and similar field cuts of pressure treated wood in accordance with AWPA U1 and M4.
- B. Treat the ends of floor joists, girders, blocking and miscellaneous framing as specified.
 - 1. Apply specified preservative to floor members and blocking with bottom edge located 2 feet or less above finished outside grade and in contact with treated sills or concrete/masonry foundation. Apply preservative treatment for 15 minutes to a distance of 6 inches from the end of the member.
 - 2. Treatment is not required for studs in contact with treated sill plates.
- C. Allow preservative to cure prior to erecting members.

3.3 FRAMING

- A. Lumber Selection:
 - 1. Select individual pieces so that knots and obvious minor defects will not interfere with connection. Install all members with crown and tight knots in the upper position.
 - 2. Do not use lumber with end splits or checks greater than the following:

- 2 x joists: Split length shall be less than or equal to one half the wide face of the member.
 - Beams or headers: Split length shall be less than or equal to the thickness of the member.
- B. Erect wood framing members level and plumb. Place horizontal members laid flat, crown side-up.
- C. Frame wall intersections with 3 continuous studs or as indicated on drawings.
- D. Construct framing members full length without splices.
- E. Provide multiple members at openings where indicated.
- 1. Form with double trimmer studs at each side, with header resting on trimmer studs, unless otherwise shown or noted. Provide single king stud each side of opening unless shown otherwise on structural drawings. Provide double sill at all cripples.
- F. Construct double joist headers at roof openings unless shown otherwise. Frame rigidly into joists.
- G. Continuously bridge joists more than 8 inch depth with solid blocking, spaced eight feet on center. Provide close fitted solid blocking at ends of members.
- H. Predrill holes for nails when necessary to prevent splitting, maximum hole size not more than 0.90 times nail diameter.
- I. Drill holes for threaded fasteners as follows:
- 1. Wood Screws larger than # 14: Drill lead holes for shank and threaded portion to 7/8 times shank and thread root diameter, respectively.
 - 2. Lag screws: Drill lead hole same diameter and depth as shank; drill hole for threaded portion to 0.7 times shank diameter.
 - 3. Bolts: Oversize hole by not more than 1/16 inch.
- J. Re-tighten all threaded fasteners before covering-up.
- K. Install sills and plates as follows:
- 1. Install preservative treated sills and plates in accordance with 2304.12.1.2, Chapter 23, Part 2, Title 24, CCR.
 - 2. Bolt to foundations and slabs. Place washers and nuts tightened to level bearing.
 - 3. Provide double top plate in all partitions and walls. Stagger joints in the upper and lower members of the top plate not less than 4 feet. Splice top plates with a minimum of 12-16d each side of splice unless otherwise shown on the drawings.
- L. Cutting:

1. Provide all cutting of framing members to accommodate structural members, piping, conduit, ducts, and building system equipment and fixtures.
2. Obtain Architects and DSA approval prior to cutting of structural framing not detailed on structural drawings.
3. Notching: Notching is not permitted in framing without DSA and Architect's written approval.
4. Joists over 8 inches in depth may have maximum 2 inch diameter holes bored at the joist center and within the middle third of the span.
5. Holes: Bored holes may be placed in studs and sills provided they are accurately centered a minimum of 12 inches apart and not over 33% of the stud/sill width in diameter.
 - Plates: Bored holes are not permitted without DSA and Architect's approval.
 - Sills: Sills may be completely cut each side of a pipe or conduit provided an additional anchor bolt or approved anchor is placed within 5 -9 inches of the end of the sill on each side of the pipe or conduit.

M. Framing for Connectors

1. Where roofing, plaster or other finish occurs, all straps, seats, bolts, and nuts which occur on the exposed exterior face of beams or posts shall be "let-in," dapped or countersunk to be flush with the face of the member.
2. Verify amount and method with Architect prior to proceeding.

N. Blocking and Backing Installation

1. Provide fire blocking at all concealed framing areas and spaces per Section 718,.2 Chapter 7, Part 2, Title 24, CCR. Fire blocking shall be solid framing material, 2x minimum, or approved alternate.
2. Provide draft stops at all concealed framing areas and spaces per Section 718.2, Chapter 7, Part 2, Title 24, CCR. Draft stops blocking shall be solid panels complying with referenced section and as approved by Architect.
3. Provide solid blocking at locations necessary for fastening or installing subsequent finish materials and/or products. Install as required to provide flush surface in final installation.
4. Where wall sheathing is not continuous at wall surfaces, provide non-structural wall sheathing or shimming as necessary to fill in, furr out and align with structural wall sheathing with subsequent finish materials.

5. Install wood stripping where indicated on the drawings or required at right angles to supported members and securely nail into place. Space as indicated. Align and level stripping by shimming where necessary. Provide stripping or blocking to conceal all plumbing, conduit, and other items shown installed in framing, whether such stripping is shown or not.
6. Provide all wood grounds and nailers, shaped as shown or required. Provide required backing for all trim wall finish, cabinets, light fixtures, mechanical plumbing and electrical apparatus, include boxing required for flush installations. Coordinate with work in other Sections for rough-in dimensions.
7. Provide 2 x 4 flat solid blocking at all plywood roof sheathing edges, whether shown or not, and including roof penetrations and openings. Coordinate with work in other Sections for rough-in dimensions.

3.4 SHEATHING

- A. Secure roof sheathing with face grain perpendicular to framing members with ends staggered. Secure sheet edges over firm bearing. Provide solid blocking at all sheathing edges. Use of ply-clips is not acceptable.
 1. Attachment of roof sheathing may be accomplished by machine nailing subject to approval of the Architect and DSA inspector. Over penetration of the face ply or improper maintenance of edge distances will be cause for rejection or termination of use.
 2. Provide 1/8 inch spacing between panel edges.
 3. At horizontal diaphragms, install sheathing in minimum 4 x 8 foot full size sheets wherever possible.
 - Where construction does not permit full size sheets, provide minimum 2 foot wide sheathing panel dimension.
- B. Secure floor sheathing with face grain perpendicular to framing members with ends staggered. Secure sheet edges over firm bearing. Use solid blocking at all sheathing edges.
 1. Install using approved threaded or ring shank fasteners, flush but not below face veneer. At all resilient flooring conditions, fasten at maximum 6 inches on center spacing. Do not fill fasteners.
 2. Provide approved adhesive at all panel edges and at all supporting framing. Glue in accordance with APA AFG 01 System criteria.
 3. Provide 1/8 inch spacing between panel edges.
 4. At horizontal diaphragms, install sheathing in minimum 4 x 8 foot full size sheets wherever possible.
 - Where construction does not permit full size sheets, provide minimum 2 foot wide sheathing panel dimension.

- C. Secure wall sheathing with face grain perpendicular or parallel to wall studs, with ends staggered, over firm bearing.
 - 1. Provide 1/8 inch spacing between panel edges.
 - 2. At vertical diaphragms, install sheathing in minimum 4 x 8 foot full size sheets wherever possible.
 - Where construction does not permit full size sheets, provide minimum 12 inch wide sheathing panel dimension.
- D. Where specified, place building paper over wall sheathing; weatherlap joints.
- E. Place temporary protection over floor and roof sheathing as required to protect sheathing from delamination and splitting.

3.5 TOLERANCES

- A. Location: 1/4 inch maximum from true position.
- B. Plumb: Limit wall framing deviation from plumb to a maximum of 1/4 inch over 10 feet, non-cumulative.
- C. Line: Limit wall framing deviation from line to a maximum of 1/4 inch in any 10 foot length, non-cumulative.

END OF SECTION

SECTION 06 17 33

WOOD I-JOISTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Wood chord and structural panel web joists for floor and roof framing.
- B. Bridging, bracing, and anchorage.
- C. Framing for openings.

1.2 REGULATORY REQUIREMENTS

- A. *Comply with Chapter 16 and 23 of Part 2, Title 24, CCR.*

1.3 REFERENCES

- A. California Building Code (CBC) 2022 edition
- B. APA - American Plywood Association.
- C. UL - Fire Resistance Directory.
- D. ALSC - American Lumber Standards Committee: Softwood Lumber Standards.
- E. ASTM D2559 - Adhesives for Structural Laminated Wood Products for use Under Exterior Exposure Conditions.
- F. ASTM D5055 - Standard Specification for Establishing and Monitoring Capabilities of Pre-Fabricated Wood I - Joists.
- G. FSC - Forest Stewardship Council.
- H. ICC - (International Code Council) Evaluation Service, Inc.
- I. National Bureau of Standards - Product Standard PS-1-95 for Construction and Industrial Plywood.

1.4 QUALITY ASSURANCE

- A. Manufacturer
 - 1. Manufacturer shall have produced the specified products for a period of five (5) years prior to beginning work of this section, and shall have the capability to produce the specified products to the delivery and quantity criteria of the project.
 - 2. Manufacturer shall submit documentation demonstrating compliance with jurisdictional authority approved quality control program, including in-plant inspection by an approved testing and inspection laboratory.

B. Fabricator/Erector

1. For fabrication and installation of work, use only personnel who are thoroughly trained and experienced in the skills required, have installed similar applications of the specified products within one year prior to beginning work of this section, and who are completely familiar with the manufacturers' recommended methods of installation, as well as the requirements of this work.

C. Substitution requirements of alternate I-Joist systems.

1. Submit substitutions per provisions of Section 01 25 00.
2. Current ICC Evaluation Service Report, is a prerequisite to consideration under the provisions of Section 01 25 00.
3. Proposed alternate shall have same Section Modulus or greater and the product of the Moment of Elasticity and Moment of Inertia (EI) as the specified product. Alternate joist dimensions and depths will not be allowed without the specific approval of the Architect and the Structural Engineer.
4. No Change Order for extension of time for any cause will be allowed in relationship to any proposed alternative product. No time extensions will be permitted for substitutions.
5. Continuous inspection of fabrication and testing by a special inspector approved by the Local Governing Agency will be required for all substitutions. Cost of such inspection shall be paid by the Owner and back-charged to the Contractor. Test methods required to demonstrate equivalency to the specified I-joist shall be determined by the Architect and the Structural Engineer.
6. The Contractor shall pay all filing and review fees caused by the substituted I-joist system, including joists, sheathing, bridging and related components, blocking and installation of the alternate system.
7. The additional cost of design, engineering, review by Architect and Structural Engineer and all costs of construction resulting from the use of the substituted I-joist system shall be paid by the Contractor.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings:

1. Submit shop drawings prepared under supervision of a civil engineer, licensed in the State of California.
2. Shop drawings shall include complete details and procedures and diagrams. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate framing system, sizes and spacing of joists, loads and joist cambers, bearing and anchor details, bridging and bracing, and framed openings.

3. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as work of other sections.
 4. Shop drawings shall clearly identify, in graphic form, all deviations from contract documents. Provide complete description and rationale for deviation.
 5. Clearly identify all changes made in re-submitted shop drawings. Incorporate changes necessary due to field conditions in re-submittal.
- C. Product Data/Materials List
1. Submit producer's or manufacturer's specifications and installation instructions. Include laboratory test reports and other data to show compliance with specifications, including specified standards.
- D. Engineering Submittal Criteria:
1. Submit calculations prepared under the direct supervision of a Civil Engineer licensed in the State of California.
 2. Structural Calculations: Produce calculations in booklet form, 8-1/2 x 11 inch size. Conform to the requirements of Section 4-317, Part 1, Title 24, CCR.
 3. Provide sufficient information with respect to design criteria, analysis methodology and material capacity to adequately evaluate proposed structural system for compliance with applicable sections of Title 24, CCR.
- E. Fire Resistive Assemblies:
1. After reviewing all relationships and building system components, provide written certification that specified system will provide fire resistive assembly as shown on drawings.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 01 60 00. Store and protect products under provisions of Section 01 60 00.
- B. Transport and store joists in vertical position resting on bearing ends.
- C. Protect joists from moisture, warping, and distortion during transit and when site stored.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements are as shown on shop drawings.

2 PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Redbuilt, www.redbuilt.com, or approved equal.

- B. Series: Red-I I-Joist, as shown on drawings and as specified in this Section
- C. Characteristics:
 - 1. Chord: Micro-laminated LVL per ICC Report ESR-2994.
 - 2. Web: Performance Plus Oriented Strand Board (OSB), meeting APA PS-2 criteria, Exposure 1, minimum 7/16 inch thickness, and complying with ICC ESR 1153.
 - 3. Joist Bridging: Type, size and spacing required by joist manufacturer, and as shown on drawings.

2.2 ACCESSORIES

- A. Wood Blocking, Plates, Support Members, and Framing for Openings: Per Section 06 11 00.
- B. Fasteners: Steel, type to suit application and per Section 06 11 00.

2.3 FABRICATION

- A. Verify dimensions and site conditions prior to fabrication.
- B. Design joists in accordance with approved *CBC* standards. Provide system designed for dead and live loads as shown on drawings.
 - 1. Dead Loads: Carefully review drawings and referenced sections of this specification. Design structural system to respond to loads imposed by such materials and assemblies as specified.
 - 2. Deflection: Limit deflection as indicated on drawings.
- C. Include all extended ends and ceiling extensions, headers, bridging, shear blocks and panels, end supports, and end anchors required for complete installation

2.4 OTHER MATERIALS

- A. Provide all other materials, not specifically described but required for complete and proper installation of this work, as selected by the contractor and subject to the approval of the Architect.

3 PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection
 - 1. Prior to work of this section, carefully inspect previously installed work. Verify all such work is complete to the point where this installation may properly commence.
 - 2. Verify that work of this section may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.
 - 3. In the event of discrepancy, immediately notify the Architect.

4. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 INSTALLATION

- A. Install joists in accordance with manufacturer's instructions.
- B. Place joists true to line and level. Provide temporary bracing to position joists in place until permanently secured.
- C. Place permanent bridging, bracing, and anchors to maintain joists straight and in correct position before installation of decking or inducing loads.
- D. Do not field cut joist flanges.
- E. Place headers and supports to frame openings required.

3.3 ERECTION TOLERANCES

- A. Tolerances shall not be cumulative.
- B. Install joists aligned within 1/4 inch of true location.
- C. Install joist plumb and level, plus or minus 1/4 inch in 10 feet.

END OF SECTION

SECTION 06 18 00

GLUE-LAMINATED CONSTRUCTION

1. PART 1 - GENERAL

1.2 SECTION INCLUDES

- 1.1.1. Structural glue laminated wood beams.
- 1.1.2. Steel hardware and attachment brackets.

1.3 REFERENCES

- A. California Building Code (CBC) 2022 edition.
- B. ANSI/AITC A190.1 – American National Standard for Wood Products – Structural Glued Laminated Timber.
- C. ASTM D 2559 - Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions.
- D. ASTM D 3737 – Standard Practice for Establishing Allowable Properties for Structural Laminated Timber (Glulam).

1.4 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacture of glue laminated structural units with five years minimum experience, certified by the AITC, and approved by DSA.
- B. Grade Stamp: Grade stamp each beam with AITC Quality Mark or other approved grade marking.

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Indicate framing system, sizes and spacing of members, loads and cambers, bearing and anchor details, bridging and bracing
- C. Provide technical data on wood preservative materials, application technique, and resultant performance information.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 01 60 00.
- B. Store and protect products under provisions of Section 01 60 00.
- C. Protect members in accordance with AITC requirements; bundle wrap concealed beams, individually wrap beams that will be exposed to view.
- D. Leave individual wrapping in place until finishing occurs. Open ends of wrapping and loosen at job site to facilitate air circulation.

2 PART 2 - PRODUCTS

2.2 GLUE LAMINATED TIMBER: EXTERIOR APPLICATIONS

- A. Lumber: Douglas Fir-Larch, Section 2303, Chapter 23, Part 2, Title 24, CCR.
- B. Grade: Architectural Appearance Grade.
- C. Finish: Smooth Surfaced.
- D. Adhesive: Exterior wet use type, complying with ASTM D 2559; for wet use condition.
 - 1. *No added urea formaldehyde is to be used on glue laminated timber placed on the interior of the project whether shop applied or applied on-site.*
- E. Structural Rating: 24F – V8, DF/DF.
- F. Condition of use: Wet (*Dry - seldom*).

2.3 GLUE LAMINATED TIMBER: INTERIOR APPLICATIONS

- A. Lumber: Douglas Fir-Larch, Section 2303, Chapter 23, Part 2, Title 24, CCR.
- B. Grade: Architectural Appearance Grade.
- C. Finish: Smooth Surfaced.
- D. Adhesive: Exterior wet use type, complying with ASTM D 2559; for wet use condition.
 - 1. *No added urea formaldehyde is to be used on glue laminated timber placed on the interior of the project whether shop applied or applied on-site.*
- E. Structural Rating: 24F-V8, DF/DF.
- F. Condition of use: Dry (*Wet if MC greater than 16 per - seldom*).

2.4 FABRICATION

- A. Fabricate glue laminated structural members in accordance with Section 2303.1.3, Part 2, Title 24, CCR and ANSI/AITC Standard A190.1 for specified Grade.
- B. Verify dimensions and site conditions prior to fabrication.
- C. Cut and fit members accurately to length to achieve tight joint fit.
- D. Fabricate member with camber built in.
- E. Do not splice or join members in locations other than that indicated, without permission of Architect, Structural Engineer.
- F. Fabricate steel hardware and connections with joints neatly fitted, welded, and ground smooth.

- G. Separate all end joints in adjacent laminations in accordance with ANSI/AITC A190.1.
 - 1. Areas requiring 6 inch spacing are shown on drawings.
 - 2. Where occurs, separate joints in adjacent laminations of arched members as required for bending members.
- H. Control moisture content at time of gluing and fabrication in accordance with Section 2303.1.3, Chapter 23, Part 2, Title 24, CCR, and as follows:
 - 1. Maximum moisture content at time of gluing: *12 percent // 10 percent for projects located in desert areas//16 percent for projects in coastal areas.*
 - 2. Minimum moisture content at time of gluing: 7 percent.
 - 3. Maximum moisture content at time of gluing for members exposed to direct sunlight in the finished structure: *10 percent // 12 percent for Alaskan Cedar.*
 - 4. Range of moisture content of laminations assembled into a single member at time of gluing: 5 percent.
- I. Notches: No notching or boring permitted, unless specifically detailed.
- J. Dry-use type adhesives are not permitted.

2.5 OTHER MATERIALS

- A. Provide all other materials, not specifically described but required for complete and proper installation of this work, as selected by the contractor and subject to the approval of the Architect.

2.6 SOURCE QUALITY CONTROL

- A. Continuous fabrication inspection to be provided for under the provisions of Section 01 45 29.
 - 1. Glue-Laminated Timber: Section 1705A.5.4, Chapter 17A, Part 2, Title 24, CCR, ANSI/AITC Standard A190.1 and ASTM D 3737 for specified Grade.
 - 2. Provide verified report certifying inspection in compliance with Section 01 45 29 of this Project Manual and 170A.6, Chapter 17, Part 2, Title 24, CCR. ANSI certification is not acceptable.

3 PART 3 - EXECUTION

3.2 SURFACE CONDITIONS

- A. Inspection
 - 1. Prior to work of this section, carefully inspect previously installed work. Verify all such work is complete to the point where this installation may properly commence.

2. Verify that work of this section may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.
 - Verify sufficient end bearing area is provided.
3. In the event of discrepancy, immediately notify the Architect.
4. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.3 PREPARATION

- A. Coordinate placement of bearing support items.

3.4 ERECTION

- A. Set structural members level and plumb, in correct positions.
- B. Provide temporary bracing and anchorage to hold members in place until permanently secured.
- C. Fit members together accurately without trimming, cutting, or any other unauthorized modification.

3.5 TOLERANCES

- A. Framing Members: 1/4 inch maximum from true position.

END OF SECTION

SECTION 06 40 00

ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide mill fabricated architectural woodwork with accessories as required for complete finished installation including cabinetwork hardware.
 - 1. Provide custom wood cabinetwork.
 - 2. Provide countertops.
- B. Related Sections:
 - 1. Section 06 10 53: Miscellaneous rough carpentry.

1.2 REFERENCES

- A. North American Architectural Woodwork Standards, 3.1 (NAAWS).

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's literature for manufactured items.
- B. Shop Drawings: Indicate materials and wood species, component profiles, fastening, joining details, finishes, and accessories.
 - 1. Certification: Provide Woodwork Institute Certified Compliance Label on shop drawings.
- C. Samples: Furnish samples of each exposed finish.
 - 1. Veneers: After approval of type of wood for veneer submit not less than three potential flitches of matching wood veneers to be reviewed by Architect each with enough veneering available for Project.
 - a. Where Architect cannot visit location of flitch do factory floor layout of flitch indicating total appearance on casework and submit photographs with true color of each flitch.
 - 2. Furnish samples of each exposed casework hardware.
 - 3. Furnish samples of wood paneling showing corner and edge treatment.

1.4 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives, sealants, and caulks, for composite wood products formaldehyde limitations, and for paints and coatings.

- B. Fabricator Qualifications: Member of Sponsor of North American Architectural Woodwork Standards with minimum five years successful experience fabricating woodwork like that required for Project.
- C. Standards: Perform architectural woodwork in accordance with North American Architectural Woodwork Standards (NAAWS).
 - 1. Certified Compliance Program (CCP): Comply with Woodwork Institute "Certified Compliance Program (CCP) as defined in NAAWS.
- D. Seismic Anchorage: Provide seismic anchorage for wall cabinets as required by California Code of Regulations (CCR), Title 24, Part 2.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver architectural woodwork until site conditions are adequate to receive work; protect items from weather while in transit.
 - 1. Allow architectural woodwork shop finish to completely dry prior to delivery to site; allow materials to off-gas volatile organic compound (VOC) emissions off site.
- B. Store materials indoors, in ventilated areas with constant but minimum temperature of 60-degrees F and maximum relative humidity of 25% to 55%.
- C. Do not begin installation of architectural woodwork until space is fully enclosed and mechanical systems are fully operational.
 - 1. Maintain interior installation areas at 70 degrees F and 50% to 55% relative humidity.
- D. Immediately remove from site materials with visible mold and materials with mildew.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Description: Provide mill fabricated architectural woodwork with accessories as required for complete finished installation including cabinetwork hardware.
- B. Plastic Laminate Finished Casework and Countertops:
 - 1. Quality: NAAWS/Custom Grade frameless, flush overlay, unless otherwise indicated.
 - a. Special: Provide each single length section of casework in largest such sections as access and openings allow.
 - 1) Multiple self-supporting units fastened together to form larger unit allowed only where access and openings do not allow single lengths.
 - 2. Plastic Laminates:
 - a. Types: NEMA LD-3.1 high pressure laminates.

- 1) Horizontal Surfaces: General Purpose Type, nominal 0.050".
 - 2) Vertical Surfaces: Vertical Surface Type, nominal 0.032".
 - 3) Unexposed Surfaces: Balanced with 0.030" melamine backing sheet.
 - 4) Formed Surfaces: Postforming Type, nominal 0.042".
- b. Solid Color Laminates:
- 1) Formica Corp. (**Basis of Design – 8751 Mojave, Matte Finish**)
 - 2) Wilsonart, Wilsonart Engineered Surfaces/Solicore.
 - 3) Substitutions: Refer to Section 01 25 00.
3. Wood Core: Plywood or medium density fiberboard (MDF) or particleboard, with no added formaldehyde and free of toxic materials.
- C. Casework Hardware: Provide casework hardware items as required for complete installation as indicated; provide types as listed in North American Architectural Woodwork Standards for casework, but no less than following types.
1. Plug-In Pin Type Shelf Supports (Transparent Finished Casework): Match BHMA A156.9 B04013 spoon type plug-in supports; provide holes 1" on center.
 2. Adjustable Shelf Standards and Supports (Plastic Laminate and Opaque Painted Casework): Match BHMA A156.9 B04073 adjustable standards and B04083 closed shelf rest brackets for mortis mounting; flush mounted in cabinet.
 3. Cabinet Hinges: BHMA A156.9 B01602 or B01603 frameless European concealed type, minimum 160 degree opening, with spring closer.
 4. Cabinet Pulls: Back mounted wire type, 4" center to center, clear aluminum; as approved by Architect.
 5. Drawer Slides: Full extension, rail mounted type, minimum 100 lb. capacity with ball-bearing rollers; self-closing.
- a. Manufacturers:
- 1) Accuride.
 - 2) Knape & Vogt.
 - 3) Blum.
 - 4) Hettich International.
 - 5) Substitutions: Refer to Section 01 25 00.
6. Cabinet Locks: Pin and tumbler slide bolt lock with five pin tumblers as approved by Architect, two keys each.
 7. Magnetic Catches: BHMA 156.9 B03141.

- D. Quartz-Based Solid Polymer Countertops: Manufacturer's standard quartz-based polymer system with color throughout thickness; provide manufacturer recommended joint adhesive; exposed surfaces finished to match top.
 - 1. Manufacturers:
 - a. Dal-Tile Corp. (**Basis of Design – One Quartz Surfaces, Fresh Linens NQ66**)
 - b. CaesarStone USA/CaesarStone
 - c. Cambria USA/Cambria Countertops.
 - d. Substitutions: Refer to Section 01 25 00.
 - 2. Quality: NAAWS/Premium Grade.
 - 3. Type: Not less than 1/2" thick sheet; coordinate with sink bowls as indicated and as specified in Division 22.

2.2 FABRICATION

- A. General: Fabricate architectural woodwork in accordance with specified North American Architectural Woodwork Standards.
- B. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Make corners and joints hairline; slightly bevel arises.
 - 1. Locate butt joints at least 2'-0" from cutouts.
 - 2. Cap exposed edges with plastic laminate of same finish and pattern.
 - 3. Apply laminate backing sheet to reverse side of laminate surfaces.
 - 4. Provide cutouts for inserts, fixtures and fittings; verify locations from on-site dimensions.
 - 5. Prime paint contact surfaces of cutouts.
- C. Countertops: Provide maximum sizes available. Locate butt joints at least 2'-0" from cutouts where more than one-piece countertops are required.
 - 1. Make corners and joints hairline; slightly bevel arises.
 - 2. Provide cutouts for inserts, fixtures and fittings; verify locations from on-site dimensions.
 - 3. Splashes and edges as indicated or as directed by Architect where not otherwise indicated.
- D. Use exposed fastening devices or nails only when approved and unavoidable; arrange neatly.
- E. Assemble woodwork in shop in sizes easily handled and to ensure passage through building openings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible; do not delay job progress, allow for trimming and fitting.

3.2 INSTALLATION

- A. Install work consistent with Architectural Woodwork Standards specified quality grade, plumb, level, true and straight with no distortions.
 - 1. Shim as required, using concealed shims.
- B. Ensure mechanical and electrical items affecting architectural woodwork are properly placed, complete, and have been inspected by Architect prior to commencement of installation.
- C. Secure work to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation.
- D. Scribe and cut for accurate fit to other finished work.
- E. Install architectural woodwork under supervision of factory-trained mechanics.
- F. Attach architectural woodwork securely in place with uniform joints providing for thermal and building movements.
- G. Paneling: Provide fire-treated wood stops eight feet on center at paneling where required by applicable codes when paneling is not direct applied to substrate.
- H. Acceptable Tolerances:
 - 1. Variation from True Position: Maximum 1/16" at any position and maximum 1/8" in any 10'-0" length.
 - 2. Adjoining Surfaces of Same Material: No variation permitted.
 - 3. Offset with Abutting Materials: Maximum 1/32".

END OF SECTION

SECTION 07 21 00

THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide insulation and accessories as required for complete installation.
 - 1. Provide thermal batt insulation with integral vapor retarder.
 - 2. Provide poly-scrim faced batt insulation for exposed interior applications.
 - 3. Provide thermal board insulation with integral vapor retarder.
 - 4. Provide nailable surface polyisocyanurate thermal board roof insulation.
 - 5. Provide vapor retarder at interior of exterior surfaces with no other vapor retarder.
- B. Related Work:
 - 1. Section 07 24 00: Insulation integral with exterior insulation and finish system.
 - 2. Section 07 53 10: Insulation integral with elastomeric PVC membrane roofing.
 - 3. Section 07 81 00: Applied fireproofing.
 - 4. Section 07 84 00: Firestopping.
 - 5. Section 09 21 00: Acoustical insulation concealed in gypsum board systems.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Interior Vapor Retarders: Where specifications require foil faced vapor retarders as part of building thermal insulation system, intent is to prevent migration of spores from mold and mildew into interior building spaces.
 - 1. Intent is to provide air barrier and vapor retarder on interior surface while allowing vapor to move through exterior wall vapor permeable surfaces, while vapor permeable water barriers are maintained at exterior side of wall.

1.3 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature for each type of insulation.
 - 1. Submit Underwriter's Laboratory approval numbers for required fire ratings; approvals of other laboratories contingent upon acceptance of applicable authorities.

1.4 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to energy efficiency.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Description: Provide thermal insulation with accessories.
- B. Thermal Batt Insulation: Preformed slag mineral or glass fiber with thermosetting resin binders, conforming to ASTM C665; formaldehyde-free.
 - 1. Manufacturers:
 - a. Johns Manville/FSK-25 Thermal-Shield Insulation.
 - b. Owens-Corning Fiberglas Corp./Fiberglas FS-25 Insulation.
 - c. CertainTeed/Thermafiber FS25 Insulation.
 - d. Substitutions: Refer to Section 01 25 00.
 - 1. R-Value: Minimum R-19 at walls, R-30 at horizontal surfaces, unless otherwise indicated.
 - 2. Flame Spread/Smoke Developed Rating: Maximum 25/450, ASTM E84.
 - 3. Vapor Retarder: Type III, aluminum vapor retarder on one side.
 - 4. Vapor Retarder: Type I: No vapor retarder.
 - 5. Combustibility: Pass ASTM E136.
 - 2. R-Value: Minimum R-19, unless otherwise indicated.
 - 3. Flame Spread/Smoke Developed Rating: Maximum 25/450, ASTM E84.
 - 4. Vapor Retarder: Type III, aluminum vapor retarder on one side.
- C. Thermal Batt Exposed Ceiling Insulation: Preformed batt insulation with white poly-scrim-kraft or similar vapor retarder facing meeting specified fire rating and intended for exposed applications. Provide at exposed to structure rooms as indicated on plans.
 - 1. Manufacturers:
 - a. CertainTeed/Post Frame Poly-Scrim-Kraft (PSK) Fiber Glass Insulation.
 - b. Substitutions: Refer to Section 01 25 00.
 - 2. R-Value: Minimum R-38, unless otherwise indicated.
 - 3. Flame Spread/Smoke Developed Rating: Maximum 25/450, ASTM E84.
- D. Thermal Board Insulation: Preformed slag mineral or glass fiber with thermosetting resin binders forming rigid board, conforming to ASTM C612.
 - 1. Manufacturers:
 - a. Johns Manville/Insul-Shield Insulation.
 - b. Owens-Corning Fiberglas Corp./Fiberglas 700 Series Insulation.

- c. CertainTeed/CertaPro Commercial Board Insulation.
 - d. Substitutions: Refer to Section 01 25 00.
- 2. Thickness: Minimum 1" unless otherwise indicated; fill furring channel space between wall and gypsum board.
- 3. Flame Spread/Smoke Developed Rating: Maximum 25/450, ASTM E84.
- 4. Combustibility: Pass ASTM E136.
- 5. Vapor Retarder: Type I, unfaced.
- 6. Vapor Retarder: Type III: Aluminum vapor retarder on one side.
- E. Thermal Board Insulation with Foil Face: Provide foam insulation intended for use with roofing systems; with foil facing, conform to ASTM C1289, Type I, Class I. Coordinate with 07 53 10 Elastomeric PVC Membrane Roofing
 - 1. Manufacturers:
 - a. Dow Chemical Co./Thermax Metal Building Board or Thermax Sheathing.
 - b. Atlas Roofing Corp./ACFoam Supreme.
 - c. RMAX, Inc./Thermarook Plus-3.
 - d. Substitutions: Refer to Section 01 25 00.
 - 2. Thickness: As indicated on Drawings.
 - 3. Thermal Resistance: Not less than R-30 total Long-Term Thermal Resistance (LTTR) unless otherwise indicated.
- F. Continuous Insulation at Exterior Walls (Exposed to Water): ASTM C1289, Type I, Class I foam insulation designed specifically for continuous insulation at exterior walls and acceptable for application over weather barrier/underlayment.
 - 1. Manufacturers:
 - a. Dow Chemical Co./Thermax ci Exterior Insulation.
 - b. Hunter Panels/Xci Products.
 - c. Atlas Roofing Corporation/EnergyShield Continuous Wall Insulation.
 - d. Rmax/ECOMAXci System.
 - e. Substitutions: Refer to Section 01 25 00.
 - 2. Basis of Design: Dow Chemical Co./Thermax ci Exterior Insulation.
 - 3. Seal joints, penetrations, and perimeters with Dow/Liquidarmor CM Sealant and Flashing or comparable materials by other specified manufacturers.
 - 4. Standards: Provide insulation approved for UL U424 fire tested assemblies and for NFPA 285.
 - 5. Thickness/r-Value: Thick as indicated, with minimum r-5 per inch.

- G. Continuous Exterior Insulation: See 07 24 00 Exterior Insulation and Finish System
- H. Separate Vapor Retarder (Interior of Exterior Walls): Provide reinforced polyethylene or foil-polyester film vapor retarder; maximum permeance rating of 0.13 perm.
 - 1. Manufacturers:
 - a. Raven Industries, Inc./Dura-Skrim 6ww.
 - b. Reef Industries, Inc./Griffolyn T-65.
 - c. Alumiseal Corp./Zero Perm.
 - d. Substitutions: Refer to Section 01 25 00.
- I. Accessories: Furnish as recommended by insulation manufacturer for insulation types, substrates, and conditions involved.
 - 1. Fasteners and Attachment Devices: Comply with insulation manufacturer recommendations for attachment of insulation.
 - 2. Fasteners to withstand loads specified for system.
 - 3. Vapor Retarder Tape: Minimum 2" wide self-adhering type designed to maintain vapor retarder integrity and complying with fire resistance ratings as required by applicable codes.
 - 4. Penetration Type Insulation Supports: Galvanized or electroplated steel penetration supports with adhesive attachment to substrate and support disc.
 - 5. Hat Channels for Special Fibrous Continuous Insulation: Types as indicated and as recommended by insulation manufacturer for applications indicated.
 - 6. Thermal Break Insulation Supports for Continuous Insulation: Provide attachment system designed specifically for supporting both continuous insulation and exterior building cladding systems indicated.
 - a. Manufacturers:
 - 1) Armatherm (844.360.1036)/Armatherm Z Girt Structural Thermal Break.
 - 2) Knight Wall Systems (855.597.9255)/CI or HCI System.
 - 3) Substitutions: Refer to Section 01 25 00.
 - b. Provide system recommended by manufacturer for applications indicated with accessories as required for complete thermally-broken continuous insulation system in configurations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify substrate and adjacent materials are dry and ready to receive insulation; beginning installation signifies acceptance of conditions.
- B. Ensure mechanical and electrical items affecting work are properly placed, complete, and have been inspected by Architect prior to commencement of installation.

3.2 INSTALLATION

- A. General: Install insulation in accordance with manufacturer's instructions and applicable code requirements. Cut and trim insulation neatly, to fit spaces.
 - 1. Fit insulation tight within spaces and tight to and behind mechanical and electrical services within insulation plane; leave no gaps or voids; maintain integrity of thermal barrier.
 - 2. Backed Insulation: Use insulation free of ripped backs and edges.
 - 3. Insulations with Vapor Retarder Facing: Install insulation with integral vapor retarder with vapor retarder toward inside of building.
- B. Batt Insulation: Friction fit batt insulation in place; use tape or penetration supports as necessary to assure permanent installation.
 - 1. Taping: Tape joints and tears in integral vapor retarder, including joints between insulation and surrounding construction, to ensure vapor-tight installation.
 - 2. Taping: Tape tears in integral vapor retarder.
 - 3. Penetration Supports: Cut or bend pins in locations accessible to maintenance personnel, to eliminate potential hazards from exposed pin points.
- C. Nailable Surface Roof Insulation: Secure using fasteners recommended by insulation manufacturer for application indicated and capable of resisting wind loads specified for roofing systems applied over nailable surfaced roof board insulation.
- D. Blown-In Insulation: Apply in accordance with manufacturer's instructions to achieve specified thermal resistance and monolithic blanket of uniform density.
 - 1. Assure clips, hangers, supports, sleeves, and other items installed within insulation space are in place before applying insulation.
 - 2. Remove excess, overspray, droppings and debris.
- E. Spray-Foam Insulation: Apply in accordance with manufacturer's instructions to achieve specified thermal resistance and uniform coverage and density.
 - 1. Assure clips, hangers, supports, sleeves, and other items installed within insulation space are in place before applying insulation.
 - 2. Remove excess, overspray, droppings and debris.
- F. Spray-On Insulation: Apply in accordance with manufacturer's instructions to achieve specified thermal resistance, complete adherence to substrate, and monolithic blanket of uniform density.
 - 1. Verify bond requirements and compatibility of substrates; use recommended procedures to minimize unsafe conditions.

2. Clean substrate of dirt, dust, grease, oil, loose particles and materials which could adversely affect bond of insulation.
 3. Assure clips, hangers, supports, sleeves, and other items penetrating insulation are in place before applying insulation.
 4. Protect applied insulation from construction operations and patch as needed to maintain thermal value.
 5. Remove excess, overspray, droppings and debris.
 6. Apply sealer to materials exposed in finished construction and where recommended by manufacturer or required by applicable codes.
- G. Continuous Insulation Installation: Comply with manufacturer recommendations and installation instructions for continuous insulation for use in systems indicated.
- H. Separate Vapor Retarder: Install vapor retarder in accordance with manufacturer's recommendations and installation instructions for complete vapor retarder installation.
1. Tape joints and tears in vapor retarder.
 2. Seal vapor retarder to penetrations.

END OF SECTION

SECTION 07 24 00
EXTERIOR INSULATION AND FINISH SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide drainable high-performance exterior insulation and finish system consisting of polystyrene insulation and synthetic plaster finish with metal framing, sheathing, anchorages, related flashings, and accessories.
 - 1. Rainscreen System: System is designed using rainscreen concept where primary water barrier is just before sheathing and exterior components are designed to allow water within system to drain back to exterior.
 - 2. Support System: Provide complete structural support system of cold-formed metal framing for system, including design of support system.
 - 3. Joint Sealants: Provide joint sealants at system.
 - 4. Other Substrates: System includes application of synthetic plaster finish over other substrates without full insulation and sheathing.
- B. Related Sections:
 - 1. Section 07 60 00: Metal cap flashings.
 - 2. Section 07 90 00: Joint sealers not at EIFS.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Design/Build: Provide special engineering to ensure compliance with applicable codes and Contract Documents.
- B. Pre-Installation Meeting: Convene not less than one week prior to commencing work of this Section. Require attendance of those directly affecting work of this Section.
 - 1. Review installation procedures and coordination required with related work.

1.3 SUBMITTALS

- A. Product Data: Submit literature for system and each manufactured component.
- B. Shop Drawings: Clearly indicate dimensioning, panel layout, general construction details, anchorages and method of anchorage.
 - 1. Field Applications: Indicate locations of cold joints for Architect approval.
- C. Samples:

-
1. Finish: Submit samples of each color and texture of finish.
 2. Joint Sealer: Submit samples of each color of joint sealer.

D. Certificates:

1. Contract Document Review: Submit system manufacturer's certification noting Contract Documents have been thoroughly reviewed and conditions and substrates are acceptable and in conformance with applicable codes.
 - a. Inform Architect where conditions and substrates vary from manufacturer's standard recommendations.
2. Installation: Submit manufacturer's representative's certification work has been installed in accordance with manufacturer's recommendations.
3. Joint Sealer Applicator: Submit joint sealant manufacturer certification applicator is trained and is acceptable for Project joint sealer installation.

E. Extra Materials: Provide maintenance materials for system to Owner's maintenance staff, along with instructions regarding proper storage and use of maintenance materials.

1. Provide minimum one 5 gallon can of each finish and color of finish used on Project.

1.4 QUALITY ASSURANCE

- A. CALGreen Sustainability Requirements: Comply with CALGreen requirements including those relative to energy efficiency and for paints and coatings.
- B. Qualification of Installer: Minimum five years successful experience in projects of similar scope, trained by system manufacturer with current certificate of training from manufacturer.
 1. Sealant Installer Qualifications: Trained applicator of joint sealer manufacturer with minimum five years successful experience with high performance commercial joint sealers and acceptable to sealant manufacturer.
- C. Mock-Up: Provide 10 sq.ft. of EIFS indicating proposed construction including reveals, corners, special shapes, and joint treatment.
 1. Maintain approved mock-up on site until final completion of work unless otherwise directed by Architect.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store adhesive and finish coating material under cover in cool, dry place, out of sun and above 40 degrees F.
- B. Keep reinforcing fabric covered and dry.

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- C. Store insulation and sheathing board flat; protect insulation from sunlight.
 - D. Label finish material by color and batch number for color consistency.

1.6 WARRANTY

- A. Extended Correction Period: Provide for correcting failure of system to resist damage from anticipated sources including damage from wind and water penetration. Repair system and pay for or replace damaged materials and surfaces.
 - 1. Extended correction period to be signed by Contractor, system installer, joint sealer manufacturer, and system manufacturer.
 - 2. Period: Two years.
- B. Manufacturer's Warranty: Submit manufacturer's warranty including special manufacturer services as required for manufacturer's warranty including sheathing and joint sealer.
 - 1. Period: 10 years.
 - 2. Manufacturer's warranty shall not detract from requirements of extended correction period nor from Owner's rights under implied and expressed warranties regardless of wording of manufacturer's warranty.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Parex, Inc. **(Basis of Design)**
- B. Dryvit System, Inc.
- C. Sto Corp.
- D. Pleko Systems International, Inc.
- E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide exterior insulation and finish system consisting of polystyrene insulation and synthetic plaster finish with metal framing, sheathing, anchorages, related flashings, and accessories for complete system.
- B. Regulatory Requirements: System to comply with applicable codes and regulations.
 - 1. Provide EIFS systems approved by applicable enforcement agencies; where required by agencies, provide information and supporting data necessary for approval of non-standard installations.

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- C. Design Criteria: Design system to withstand anticipated wind loads.
1. Maximum allowable deflection of spans is $L/240$.
 2. Design system to accommodate loads from other building components indicated to be supported by system.
 3. Design system to provide movement of components without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to seasonal temperature ranges.
 4. Design system to accommodate tolerances of structure.
 5. Comply with applicable code requirements for use and thickness of plastic insulation used in system.
- D. Performance Requirements:
1. Tensile Strength of Adhesive: Insulation to sheathing shall be minimum 1200 psf when tested in accordance with ASTM C297.
 2. Impact Resistance: EIMA 101.86, indentation maximum 8.5 mm, no cracking.
 3. Water Vapor Transmission: ASTM E96; insulation transmission of 1.2 to 2.0 perm-inch, finish transmission of 9.75 perm.
 4. Water and Air Leakage: System shall be free of leakage of both air and water; comply with ASTM E283 and E331.
- E. Exterior Finish Assembly System: Composite of sheathing, insulation board and two-coat synthetic plaster finish with glass fiber reinforcing.
1. System: Drawings are based on Dryvit/Outsulation Plus System
 2. Drainable or Rain Screen System: Provide manufacturer's premium grade system with pressure equalized rainscreen capabilities allowing for moisture control and drainage, and resistant to mold, mildew, and biological growth.
- F. Sheathing: Silicone treated glass mat gypsum sheathing, ASTM C1177, Type X, 5/8" thick unless otherwise indicated.
1. Manufacturers:
 - a. Georgia Pacific/DensGlass Gold.
 - b. Substitutions: Refer to Section 01 25 00.
 2. Comply with requirements specified in Section 09 21 00 - Gypsum Board Assemblies.
 3. Sheathing Fasteners: Minimum 300 series stainless steel.

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- G. Adhesive: Acrylic or combined acrylic and Portland cement mix as recommended by manufacturer and designated to be compatible both in bond strength and chemical structure, with insulation and sheathing.
1. Bond Strength: Minimum 700 psi at concrete, 300 psi at sheathing.
 2. Portland Cement: ASTM C150, type as recommended by system manufacturer for bonding adhesive.
 3. Mechanical Fasteners: Where part of manufacturer's standard system, provide manufacturer's recommended fasteners.
- H. Insulation: Polystyrene, ASTM C578, extruded or expanded type; minimum average density 1.0 pcf.
1. Fire Resistance: Provide insulation specially treated to develop maximum fire resistance based on ASTM E84 Tunnel Test, and full scale corner test of system.
 2. Special Shapes: Hot wire cut insulation in shop to special shapes indicated maintaining tolerances necessary to achieve tolerances specified for finished installation of EIFS system.
- I. Reinforcing: Balanced open weave glass fiber fabric made from twisted multi-end strands and compatible with other system materials.
1. Provide standard, intermediate, and heavy-duty mesh in accordance with system manufacturer recommendations for various locations of exterior finish assemblies on Project.
 2. Provide heavy-duty mesh where system is within 10 feet of grade and where on surfaces within reach from grade and accessible surfaces.
- J. Trim: Manufacturer's recommended plastic casing beads and trim at corners and edges of insulation.
- K. Base Coat: 100% acrylic bonding layer continuously reinforced with fiberglass fabric.
1. Thickness: As required to completely embed reinforcing.
 2. Shear bond on surface of insulation shall develop full tensile strength of reinforcing.
- L. Finish Coat: 100% acrylic finish fully bonded and compatible with base coat; formulated to preclude growth of mold and organic material.
1. Color and Finish: Manufacturer's standard as selected by Architect.
- M. Integral Waterproofing System: Copolymer based waterproofing system compatible with EIFS system components and designed to maintain integrity of system at low slope sills and parapet coping type installation.
1. Waterproofing: Concealed in system.

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- N. Joint Sealants: Type as recommended and approved by exterior finish system manufacturer.
1. Use only one type of joint sealer throughout Project, coordinate with Section 07 90 00 - Joint Sealants.
 2. Type: Tremco/Spectrum 3 or Dow Corning/790 low modulus silicone sealant; comply with EIFS system manufacturer requirements and with requirements specified in Section 07 90 00 - Joint Sealants.
 - a. Modulus: Shore A or 15.
 - b. Primer: As recommended by sealant manufacturer for substrate.
 - c. Backer Rod: AET/Sof-Rod backer.
 3. Color: Match synthetic plaster finish unless otherwise indicated.

2.3 MIXES

- A. Adhesive: Comply with system manufacturer recommendations for proportions and mixing of materials for adhesive for bonding insulation to substrates indicated on Drawings.
- B. Mix base and finish coat materials in accordance with system manufacturer recommendations and instructions; do not add materials or admixtures unless specifically approved by system manufacturer.
 1. Keep containers closed when not in use.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine substrate and verify work is complete and suitable for installation of exterior finish assemblies.

3.2 PREPARATION

- A. Do not proceed unless substrates are acceptable to manufacturer's representative and substrates are suitable to maintain tolerances specified for finished installation.

3.3 INSTALLATION

- A. Install exterior insulation and finish system in accordance with manufacturer's instructions and recommendations, and as required to comply with specified design requirements.
 1. Protect system from water during installation and until sealant is installed.
 2. Expansion Joints: Provide continuous expansion joints at following locations.
 - a. Where expansion joints occur in substrate beneath system.
 - b. Where building expansion joints occur.

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- c. Where substrate type changes.
 - d. Where significant structural movement can be anticipated such as changes in roof line, long continuous elevations, and changes in building shape and structural system.
 - B. Screw apply gypsum sheathing to metal framing in accordance with ASTM C840, sheathing manufacturer's recommendations, and system manufacturer instructions and recommendations.
 - 1. Comply with required fire ratings.
 - C. Insulation: Cut insulation to shapes as required for finished shapes indicated on Drawings.
 - 1. Apply to vertical surfaces starting from base using either permanent or temporary support.
 - 2. Apply insulation board horizontally in running bond.
 - 3. Stagger boards at corners to provide lock bond.
 - 4. Precut insulation to fit snugly around openings and penetrations.
 - 5. Rasp irregularities over 1/16" flush.
 - 6. Butt joints tight, apply pressure over entire surface of insulation to provide uniform contact.
 - 7. Install corner beads, capping beads and accessories indicated on Drawings or recommended by manufacturer.
 - 8. Corners and Edges: Straight and undamaged, remove damaged areas (minimum of 1 sf insulation) and replace with undamaged material.
 - D. Maintain surface flatness with maximum variations of 1/8" in 10 feet.
 - E. Base Coat and Reinforcing:
 - 1. Apply base coat to uniform thickness of approximately 1/16" and immediately embed reinforcing into coating.
 - 2. Reinforcing shall be continuous around corners and lapped not less than 2-1/2" at edges.
 - 3. Embed reinforcing flat without wrinkles, puckers, or fishmouths.
 - 4. Provide special reinforcing and base coat at corners to obtain maximum impact resistance.
 - 5. Apply special impact resistant reinforcing at areas requiring special protection.

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6. Apply waterproofing system at sills, parapet caps, and similar locations where system has low slope that could result in water accumulation on system.
 - F. Finish: Provide uniform surface in manner to achieve finishes as approved by Architect and matching approved samples.
 - G. Cold-Joints: Apply finish coat in continuous application to avoid cold-joints at locations other than as approved by Architect.
 1. Cold-joints include joints which result from scaffolds, breaks, end-of-day, and changes in materials that may be noticeable in cured, finished application.
 2. A uniform finish free of cold-joints is required.
 - H. Reveals: Maintain straight and true to line.
 - I. Curing: In accordance with system manufacturer's instructions.
 - J. Joint Sealers: Apply in accordance with requirements of sealant manufacturer's instructions and in accordance with requirements specified in Section 07 90 00 - Joint Sealants.
 1. Provide sealant for joints within system and at perimeters of system.
 - K. Site Tolerances:
 1. Installed Joints:
 - a. Maximum plus 1/64" variance per foot.
 - b. Maximum plus 3/16" variance per 12'-0", noncumulative.
 - c. Maximum joint width 5/16" or 3/16" less than width shown on Drawings, whichever is greater.
 2. Maximum Variation in Plane: Plus or minus 1/8".
 3. Maximum Jog in Joint Alignment: 1/8".
 4. Maximum Step in Face: 1/8".
 5. Linear tolerances are noncumulative.

3.4 SITE QUALITY CONTROL

- A. Site Water Test: Comply with AAMA 501.2 and ASTM E1105 requirements for field checking of system for water leakage; test in presence of Architect and Owner representative.
- B. Manufacturer's Field Services: Manufacturer's representative shall inspect work of Project on regular basis and provide certification exterior finish system has been installed in accordance with manufacturer's recommendations.
 1. Provide unobstructed access to work.

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2. Correct defects and irregularities as advised by manufacturer's representative.

3.5 CLEANING

- A. Immediately clean adjacent materials of exterior finish materials as work progresses.

3.6 PROTECTION

- A. Protect system until installation of flashing and sealants.

END OF SECTION

SECTION 07 26 00

BELOW-GRADE VAPOR RETARDER

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide vapor retarder system for below grade and slab-on-grade concrete, including sealing joints and protrusions through vapor retarder and sand bed below vapor retarder.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's literature.

1.3 SITE CONDITIONS

- A. Do not apply vapor retarder during inclement weather or when air temperature is below 40 degrees F.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Fortifiber Corp./Ultra 15.
- B. Raven Industries, Inc./Vapor Block # VB 15 (15 mil Blue).
- C. Stego Industries, Inc./Stego Wrap (15 mil).
- D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description Includes: Provide vapor retarder system for below grade and slab-on-grade concrete, including sealing joints and protrusions through vapor retarder and sand bed below vapor retarder.
- B. Vapor Retarder: ASTM E1745, Class A vapor retarder consisting of 15 mil polyolefin film.
 - 1. Permeance: Maximum 0.025 perms, ASTM F1249 and E154 tests.
 - 2. Resistance to Puncture: Minimum 2200 grams, ASTM D1709, Method B.
 - 3. Tear Resistance: Minimum 8.74 lbs., ASTM D1004.
 - 4. Tensile Strength: Minimum 35 lbs/in., ASTM E154, Section 9, Method D-882, in both directions.

- C. Joint Sealer: Pressure sensitive tape as recommended by vapor retarder manufacturer and providing comparable permeance to vapor retarder.
- D. Sand Bed: Clean natural sand; free from silt, clay, loam, friable or soluble materials, and organic matter.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Ensure sleeves, curbs and projections that penetrate vapor retarder are properly and rigidly installed.
- B. Ensure substrate is free of projections and irregularities that may be detrimental to proper installation of vapor retarder.

3.2 INSTALLATION

- A. Spread and roll sand to provide smooth, even bed for vapor retarder.
- B. Apply vapor retarder in accordance with manufacturer's recommendations and installation instructions and in accordance with ASTM E1643; comply with most restrictive where conflicts occur.
 - 1. Seal items projecting through vapor retarder with pressure sensitive tape.
- C. Seams: Minimum 12" overlap, sealed with pressure sensitive tape for vapor tight seal.
- D. Lay vapor retarder membrane smooth with no fish-mouths or bunches of material.
- E. Inspect and repair vapor retarder prior to application of concrete slab; tape tears and repair damage.

END OF SECTION

SECTION 07 28 00

WEATHER BARRIER/UNDERLAYMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide weather barrier/underlayment air and water barrier systems for siding, sloped roofing, flashing and sheet metal, and penetrations with accessories as required for complete watertight installation.
 - 1. Wall Underlayment: Provide vapor permeable fluid applied underlayment and flashing for exterior wall applications, with related concealed metal flashings and accessories as required for complete airtight and watertight installation. System compatible with requirements of 07 24 00 Exterior Insulation and Finish System.
 - 2. Flashings and Sheet Metal Underlayment: Provide self-adhering sheet membrane underlayment at flashings and sheet metal, with accessories as required for complete watertight installation. 07 24 00 Exterior Insulation and Finish System
 - 3. Self-Adhering Sheet Membrane (SASM) Flashing at Penetrations: Provide SASM flashing for around penetrations through building paper including windows and doors, with accessories as required for complete watertight installation. 07 24 00 Exterior Insulation and Finish System and 07 53 10 Elastomeric PVC Membrane Roofing
- B. Related Sections:
 - 1. Section 07 60 00: Exposed metal flashing.
 - 2. Section 07 24 00 Exterior Insulation and Finish System
 - 3. Section 07 53 10 Elastomeric PVC Membrane Roofing

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Weather Barriers: Provide weather barrier/underlayment systems which, with other building components, comply with applicable code requirements for air barriers and water barriers.
 - 1. Air Barriers: Air barriers shall be as defined by applicable Energy Code requirements and shall include standard exterior wall components and air seal joint sealants specified in Section 07 90 00 – Joint Sealants.

2. Water Barriers: Water barriers shall be as defined by applicable Building Code requirements and shall include vapor permeable systems with or without rainscreen barriers intended to extend amount of water drained to exterior.
 3. Interior Vapor Retarders: Where specifications require foil faced vapor retarders as part of building thermal insulation system, intent is to prevent migration of spores from mold and mildew into interior building spaces.
 - a. Intent is to provide air barrier and vapor retarder on interior surface while allowing vapor to move through exterior wall vapor permeable surfaces, while vapor permeable water barriers are maintained at exterior side of wall.
 4. Self-Adhering Flexible Flashings: Intent of flexible flashings at window openings, door openings, and other wall penetrations is to ensure water cannot move from exterior surface past water barriers and into building.
- B. Pre-Installation Meeting: Convene one week prior to commencing work; require attendance of parties directly affecting underlayment.
1. Review procedures and coordination required with related work.

1.3 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature for each type of underlayment.

1.4 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives.

1.5 WARRANTY

- A. Extended Correction Period: Provide for correcting failure of system to resist damage from anticipated sources including damage from water penetration. Repair system and pay for or replace damaged materials and surfaces.
1. Period: Two years.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Description: Provide weather barrier/underlayment air and water barrier systems for siding, sloped roofing, flashing and sheet metal, and penetrations with accessories.
- B. Regulatory Requirements: Provide materials conforming to applicable air quality management district limitations on volatile organic compound (VOC) emissions.
- C. Regulatory Requirements: Provide materials with minimum volatile organic compound (VOC) emissions available.

- D. Wall Underlay: Provide vapor permeable fluid applied air and water barrier underlayment system for complete watertight installation as recommended by manufacturer for substrates and applications indicated.
 - 1. Manufacturers:
 - a. GCP Applied Technologies (Grace)/Perm-A-Barrier VPO Fluid Applied.
 - b. Henry Company/Air-Bloc VP.
 - c. Carlisle Corp./CCW LiquiFiber-W.
 - d. Substitutions: Refer to Section 01 25 00.
 - 2. Provide specific membrane types as recommended by system manufacturers for each type of application.
- E. Wall Underlay: Provide vapor permeable water barrier type self-adhering sheet underlayment system for complete watertight installation as recommended by manufacturer for substrates and applications indicated.
 - 1. Manufacturers:
 - a. GCP Applied Technologies (Grace)/Perm-A-Barrier VPS Self-Adhering Sheet.
 - b. Henry Company/Blueskin SA and SA HT Air and Weather Barrier.
 - c. Carlisle Corp./CCW 705 MSDS.
 - d. Substitutions: Refer to Section 01 25 00.
 - 2. Provide specific membrane types as recommended by system manufacturers for each type of application.
- F. High Temperature Metal cladding and flashing Underlayment: Self-adhering sheet membrane with primers and seam sealers as required for complete watertight installation; type as recommended by manufacturer for substrate and for applications indicated.
 - 1. Manufacturers:
 - a. GCP Applied Technologies (Grace).
 - b. Henry Company.
 - c. Substitutions: Refer to Section 01 25 00.
- G. Sheet Metal and Flashing Underlayment: Self-adhering rubberized sheet membrane with primers and seam sealers as required for complete watertight installation; type as recommended by manufacturer for substrate and for applications indicated.
 - 1. Manufacturers:
 - a. GCP Applied Technologies (Grace).
 - b. Henry Company.
 - c. Carlisle Corp.
 - d. Protecto Wrap Company.
 - e. Substitutions: Refer to Section 01 25 00.

2. Provide specific membrane types as recommended by system manufacturers for each type of application.
- H. Self-Adhering Sheet Membrane (SASM) Flashing at Penetrations: SASM with primers and seam sealers as required for complete watertight installation; type as recommended by manufacturer for substrate and for applications indicated.
 1. Manufacturers:
 - a. GCP Applied Technologies (Grace).
 - b. Henry Company.
 - c. Carlisle Corp.
 - d. Protecto Wrap Company.
 - e. Substitutions: Refer to Section 01 25 00.
 2. Provide specific membrane types as recommended by system manufacturers for each type of application.
- I. Concealed Metal Flashings Integral with Underlayment: Minimum 26 gage thick steel with minimum 0.90 oz/sf galvanized coating; ASTM A653.
 1. Fasteners: Standard round wire type of hot dipped galvanized steel; minimum 19/64" head diameter and 0.104" shank diameter; minimum 7/8" long.
- J. Bituminous Paint: Acid and alkali resistant type; black color.
- K. Accessories: Provide as recommended by underlayment manufacturers for specific applications.

2.2 FLASHING FABRICATION

- A. Fabricate metal flashings as recommended by Sheet Metal and Air Conditioning Contractors National Association (SMACNA) "Sheet Metal Manual".
- B. Form flashings to drain water to exterior at roofing and siding construction for penetrations, sill and header flashings.
- C. Form sections square, true and accurate to size, in maximum possible lengths and free from distortion and other defects detrimental to appearance or performance.
- D. Hem exposed edges of metal flashings minimum 1/4" on underside.
- E. Apply bituminous paint on concealed surfaces of metal flashings.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Install underlayment over surfaces that are dry, free of ridges, warps and voids that could damage paper.
- B. Coordinate installation with installation of components and items projecting through underlayment.

3.2 FLASHINGS INSTALLATION

- A. Install flashings as recommended by Sheet Metal and Air Conditioning Contractors National Association (SMACNA) "Sheet Metal Manual".
- B. Weatherlap joints minimum 2" and seal with plastic cement; secure in place.
- C. Fastenings: Concealed in completed installation.

3.3 UNDERLAYMENT INSTALLATION

- A. Install weather barrier/underlayment in accordance with installation instructions and recommendations of each manufacturer and of manufacturers of products to cover weather barrier/underlayment; comply with applicable code requirements.
 - 1. Wall Underlayment: Provide fluid applied underlayment.
 - 2. Flashing and Sheet Metal: Provide one-layer sheet membrane underlayment.
 - 3. Penetrations: Apply one-layer of self-adhering sheet membrane extending minimum 18" from penetrations, including windows and doors; start at bottom of penetration and weatherlap joints.
 - a. Apply top layer over metal flashing to direct water to exterior.
 - 4. Weatherlap joints as recommended by system manufacturer.
 - a. Weatherlap joints not less than 2" at building paper.
 - 5. Secure underlayment in place, stagger joints between sheet membrane layers; lap ends minimum 6"; stagger end joints.
- B. Sheet Membranes: Weatherlap items projecting through sheet membrane underlayment and seal with sealer recommended by sheet membrane underlayment manufacturer.

END OF SECTION

SECTION 07 53 10

ELASTOMERIC PVC MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide reinforced polyvinyl chloride (PVC) type elastomeric sheet membrane roofing system with base flashings, insulation, roof deck board, and accessories for complete, weather-tight installation.
- B. Related Sections:
 - 1. Section 06 10 50: Wood blocking and plywood in conjunction with roofing.
 - 2. Section 07 21 00: Thermal Insulation
 - 3. Section 07 60 00: Flashing and sheet metal.

1.2 REFERENCE STANDARDS

- A. National Roofing Contractors Association: The NRCA Roofing and Waterproofing Manual.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Meeting: Convene not less than one week prior to commencing work of this section. Require attendance of parties directly affecting roofing work.
 - 1. Review procedures and coordination required with related work.

1.4 SUBMITTALS

- A. Product Data: Submit membrane manufacturer's literature for membrane and base flashing materials; provide specific recommendations of insulation system manufacturer.
 - 1. Submit membrane manufacturer's recommendations for surface conditioning, flashing, joint cover and crack sealants, and temperature range for application of materials.
- B. Shop Drawings: Submit for PVC sheet seams and insulation layout; indicate location and insulation type; provide cross section indicating layers of insulation along with R-value calculations.
- C. Samples: Submit samples of each exposed material.
- D. Certifications:
 - 1. Installer: Submit certification installer is approved for roof system installation.

2. Materials: Submit certification materials and components conform to Specifications and are compatible with each other, roof substrate, and related work.
3. Fire and Wind: Submit manufacturer's certification system conforms to fire and wind requirements.
4. Manufacturer Representative: Submit certification by manufacturer's representative indicating work has been installed in accordance with manufacturer's recommendations and installation instructions.

1.5 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to energy efficiency.
- B. Qualification of Installers: Company with minimum five years successful experienced in PVC membrane roof application on projects of similar scope.
 1. Installer: Roofing and insulation manufacturer certified or approved.
- C. Supervisor: Installer to maintain full-time supervisor/foreman who is on jobsite during roofing work who is experienced in installation of roofing system specified.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect foam insulation from direct sunlight exposure.

1.7 SITE CONDITIONS

- A. Do not apply roofing membrane during inclement weather or when air temperature may fall below 40 degrees F.
 1. Do not allow materials to be exposed to moisture during transportation, storage, handling or installation.
 2. Mark damp or wet materials, including felts which froth or foam during installation, and remove from site within 24 hours.
- B. Do not apply materials to damp, dirty, dusty, or otherwise unsuitable surfaces.
 1. Allow concrete surfaces to cure minimum 28 days.
- C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.8 WARRANTY

- A. Extended Correction Period: Provide for correcting failure of system to resist damage from anticipated sources including damage from wind and water penetration. Repair system and pay for or replace damaged materials and surfaces.
 1. Period: Two years.

- B. Manufacturer's Warranty: Submit manufacturer's warranty including special manufacturer services as required for manufacturer's warranty.
 - 1. Period: 20 years.
 - 2. Manufacturer's warranty shall not detract from requirements of extended correction period nor from Owner's rights under implied and expressed warranties regardless of wording of manufacturer's warranty.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Sika USA / Sarnafil Inc. **(Basis of Design)**
- B. Carlisle SynTec Systems.
- C. GenFlex Roofing Systems Div. GenCorp.
- D. HPG International Inc.
- E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide reinforced polyvinyl chloride (PVC) type elastomeric sheet membrane roofing system with base flashings, and accessories.
 - 1. System: Fully adhered exposed membrane.
 - 2. Provide roofing system materials by a single manufacturer, except where materials of other manufacturers are specified or approved by Architect.
 - 3. Provide roof insulation, double layer application where indicated.
 - 4. Provide tapered insulation as required to ensure positive 1/4" per foot slopes to drains.
 - 5. Provide roof deck board to separate insulation from roof membrane.
 - 6. Provide decorative ribs as indicated.
- B. Regulatory Requirements
 - 1. Cool Roof System: Comply with California Building Standards Code requirements for "Cool Roof" system including three-year aged solar reflectance value requirements.
 - a. Label: System to have Cool Roof Rating Council (CRRC) label.
 - 2. Fire and Wind Resistance: Conform to California Building Standards Code requirements for Underwriters Laboratory (UL) Class A roof system, with UL Class 60 wind resistance classification.

- a. Provide materials conforming to code requirements for roof/ceiling 1-hour fire resistive rating for components and materials indicated in Contract Documents.
- C. Roof Membrane: ASTM D4434, Polyvinyl Chloride (PVC) Elastomeric membrane, reinforced, thickness as recommended by roof membrane manufacturer for application involved, but no less than 48 mils.
 1. Scrim Reinforcing: Manufacturer's standard fleece, fiberglass, or polyester scrim.
 2. Corners and Elastomeric Membrane Flashing: Provide products using same base material as roof membrane; corners preformed.
 3. Seams: Solvent welded and seam sealant finished.
 4. UV Resistance: Provide materials with demonstrated resistance to ultraviolet light with no visible surface cracking or discoloration based on industry accepted accelerated test methods.
 5. Provide materials compounded specifically for application methods and substrates indicated on Drawings; comply with requirements for fire rated materials.
 6. Color: As indicated, as selected by Architect from manufacturer's full range of Cool Roof Rated colors where not indicated.
- D. Insulation: Provide materials approved for use with specified membrane and suitable for application indicated; provide tapered insulation where insulation is indicated to provide roof slopes.
 1. Polyisocyanurate Insulation: ASTM C1289, Type II, Class 1, Grade 2 glass fiber faced isocyanurate, with ASTM C1303 Long Term Thermal Resistance (LTTR).
 2. Other Types of Insulation: Acceptable subject to manufacturer's recommendations, application involved, and total thickness required for specified thermal resistance.
 3. Thermal Resistance: Minimum total R-38.
- E. Roof Deck Board: ASTM C1278 with moisture and mold resistant core. Provide as indicated, as required for uniform surface for membrane adherence, and as required for fire and wind ratings.
 1. Manufacturers:
 - a. Georgia Pacific/DensDeck Prime.
 - b. Johns Manville/Securock.
 - c. Substitutions: Refer to Section 01 25 00.
- F. Accessories: Provide as recommended by membrane manufacturer and system manufacturer as required for complete weather-tight installation, including, but not limited to:
 1. Bonding adhesives, splicing cement, and lap sealants and mastics.

2. Seam plates.
 3. Molded pipe flashing.
 4. Temporary sealing, for end of day closing of membrane.
 5. Mechanical fasteners.
- G. Integral Coated Metal Flashings: Provide not less than 24-gage galvanized steel flashings, minimum G90 coating, coated with PVC materials for compatibility with direct bonding to roof membrane, as recommended by system manufacturer.
- H. Roof Protection Pads: Provide protection materials as recommended by membrane manufacturer where maintenance traffic is anticipated over membrane.
- I. Decorative ribs: as indicted on roof plan

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify deck is dry, clean and smooth, free of depressions, waves and projections detrimental to roofing membrane, and properly sloped for drainage.
- B. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set and that cant strips, nailing strips, and reglets are in place.
- C. Beginning installation indicates acceptance of substrate.
- D. Metal Surfaces: Remove contaminants which may adversely affect adhesion or performance of roofing system; apply metal primer.

3.2 INSTALLATION

- A. Install membrane roofing system in accordance with manufacturer's recommendations and instructions and as required to meet requirements for warranty and applicable codes.
 1. Comply with NRCA Specification Guide for Thermoset Roof Membranes as applicable; where conflicts exist comply with manufacturer's recommendations.
- B. Insulation: Install insulation in accordance with insulation manufacturer's recommendations and roof membrane manufacturer's recommendations for installation indicated.
 1. Place insulation boards butted in close contact; stagger joints between insulation board layers.
 2. Bevel insulation to allow snug fit at penetrations; cut neatly around protrusions through roof.

- C. Roof Deck Board: Install in accordance with manufacturer recommendations and as required to ensure suitable substrate for membrane roofing over insulation, fire ratings, and wind ratings; secure to roofing deck.
 - 1. Place roof deck boards butted in close contact; stagger joints between roof deck board and insulation board joints.
 - 2. Cut to allow snug fit at penetrations; cut neatly around protrusions through roof.
- D. Roof Membrane: Apply membrane in accordance with membrane manufacturer's recommendations and installation instruction. Provide heat welded seams.
 - 1. Apply sheet membrane smooth, free from air pockets, wrinkles, fish-mouths, un-lapped joints, or tears, over first layer insulation.
 - 2. Extend roof membrane up vertical surfaces minimum 8" wherever possible and secure to nailing strips or reglets; reinforce corners with double applications of membrane.
 - 3. Install membrane flashings and seal into membrane.
 - a. Coordinate installation of roof drains and related flashings.
 - b. Coordinate installation with integral gutters and seismic movement joint assemblies. Continuous membrane through gutters as indicated.
 - 4. Seal flashings and items projecting through membrane; seal terminations with additional layer of membrane and mastic.
 - 5. Prevent compounds from entering and clogging drains, and from spilling or migrating onto surface of other work.
- E. Roof Protection Pads: Secure roof protection pads in place in accordance with membrane manufacturer recommendations and as required to ensure protection of membrane from roof maintenance traffic.
 - 1. Set pads to allow roof drainage; where pads cross drainage path set with not less than 4" and not more than 8" between pads.

3.3 FIELD QUALITY CONTROL

- A. Site Tests: Flood test roofing prior to installation of insulation and ballast; if defects are revealed, repair and repeat flood test until no defects are revealed.
 - 1. Do not overload structure with flood test; if necessary, section off areas as necessary.
 - 2. Test for leaks with 2" depth of water maintained for 24 hours.
- B. Manufacturer's Field Services: Manufacturer's representative shall inspect work of Project on regular basis and provide certification roofing system has been installed in accordance with manufacturer's recommendations.

1. Provide unobstructed access to roofing work.
2. Correct defects and irregularities as advised by manufacturer's representative.

3.4 CLEANING

- A. Remove roofing membrane markings from finished surfaces.
- B. In areas where finished surfaces are soiled by roofing work, consult manufacturer of finished surfaces for recommended cleaning methods.
- C. Leave completed roof free from debris and uniform in appearance.

3.5 PROTECTION

- A. Where work must continue over finished roofing membrane, protect surface in accordance with manufacturer recommendations.

END OF SECTION

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide metal flashings and sheet metal including accessories as required for complete weathertight installation.
 - 1. Flashing and sheet metal includes copings, fascias, scuppers, gutters, downspouts, rainwater leaders, reglets, and similar fabricated components as applicable to Project.
 - 2. Provide concealed sealants used in conjunction with installation of metal flashing and sheet metal.
 - 3. Provide miscellaneous sheet metal flashing and reglets not provided by other trades or suppliers.
 - a. Where reglets are to be installed in conjunction with other work, provide in adequate time for installation.
 - b. Where reglets are to be surface applied, provide continuous gasket between reglet and surface.
- B. Related Sections:
 - 1. Section 06 10 50: Miscellaneous rough carpentry.
 - 2. Section 07 28 00: Concealed flashing at weather barrier/underlayment.
 - 3. Section 07 41 10: Flashing and sheet metal integral with metal roofing.
 - 4. Section 07 95 00: Expansion joint cover assemblies at roofing.

1.2 REFERENCES

- A. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual.

1.3 SUBMITTALS

- A. Product Data: Furnish literature for manufactured products.
- B. Shop Drawings: Clearly indicate dimensioning, layout, general construction details including closures, flashings, locations and types of sealants, anchorages, and method of anchorage.
- C. Samples: Furnish samples of typical metal flashing fabrication indicating standard soldered joints and edge conditions.

1.4 QUALITY ASSURANCE

A. Sustainability Requirements:

- 1) two years' successful experience with CAL/Green requirements.
2. CALGreen Requirements: Refer to Section 01 35 15 – CALGreen Environmental Requirements and comply with applicable CALGreen Checklist indicating requirements applicable to Project.

1.5 DELIVERY, STORAGE AND HANDLING

- ##### A.
- Provide strippable film protective covering on shop finished flashing materials to protect materials through shipping, fabrication and installation.

1.6 WARRANTY

- ##### A.
- Extended Correction Period: Provide for correcting failure of system to resist damage from anticipated sources including damage from wind and water penetration. Repair system and pay for or replace damaged materials and surfaces.
1. Period: Two years.

PART 2 - PRODUCTS

2.1 MATERIALS

- ##### A.
- System Description: Provide flashing and sheet metal including reglets and accessories as required for complete weathertight installation.
- ##### B.
- Design Criteria: Allow for movement of components without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to 100-year seasonal temperature ranges.
- ##### C.
- Flashing and Sheet Metal:
1. Galvanized Steel: ASTM A924 and A653 G90 galvanized steel; minimum 24-gage.
 - a. Mill phosphatized where indicated to be field painted.
 - b. Location (**Concealed**): Where indicated, if not otherwise indicated, provide where flashing will not be exposed to view from exterior of building and where not exposed to view from spaces within building.
 2. Shop Finished Galvanized Steel Flashing and Sheet Metal: ASTM A924 and A653 G90 galvanized steel; minimum 24-gage; with factory applied fluoropolymer coating based on Kynar 500 or Hylar 5000.
 - a. Manufacturers:
 - 1) PAC-Clad: Premium Color Zinc (**Basis of Design**)
 - 2) Ryerson Building Products (800.328.7800)/ColorKlad.

- 3) Metal Sales Manuf. Corp.(800.406.7387)/PVDF (Kynar 500).
- 4) K&M Sheet Metal (888.567.7778)/Kynar Steel.
- 5) Substitutions: Refer to Section 01 25 00.
- b. Location (Exposed): Where indicated, if not otherwise indicated, provide where flashing will be exposed to view from exterior of building, and where exposed to view from spaces within building.
- c. Colors:
- d. Touch-up Paint for Prefinished Sheet Metal: Type recommended by fluoropolymer manufacturer for field touch-up.
3. Stainless Steel Flashing and Sheet Metal: Stainless steel, ASTM A666, Type 304, soft annealed, 2B finish, minimum 26-gage.
 - a. Location (Exposed): Where indicated, if not otherwise indicated, provide where flashing will be exposed to view from exterior of building, and where exposed to view from spaces within building.
4. Mill Finished Aluminum: ASTM B209, 3003-H14, minimum thickness 0.040" unless otherwise indicated.
5. Anodized Aluminum Sheet: ASTM B209, 5005-H14, with minimum thickness of 0.050" unless otherwise indicated.
 - a. Clear Anodized Coating: AAMA 607.1 clear anodized, Architectural Class I 0.018mm or thicker coating.
 - b. Color Anodized Coating: AAMA 608.1, Architectural Class I 0.018mm or thicker coating; color as indicated on Drawings.
6. Extruded Aluminum: ASTM B221, alloy 6063-T52, with minimum thickness of primary legs 0.080" unless otherwise indicated; clear anodized unless otherwise indicated.
7. Lead Flashing: ASTM B749, type L51121, copper-bearing sheet lead, minimum four pound per square foot (1/16" thick) lead with 6% to 7% antimony content.
8. Accessories: Provide strainers, outlet tubes, screens, baffles, hangers and gutter ends as required for a complete system and complying with SMACNA Manual.
9. Provide heavier gage metal where recommended by SMACNA Manual for size of component.
- D. Manufactured Reglets: Snap-on type, for two-piece flashing; metal to match flashing and sheet metal.
 1. Manufacturers:
 - a. Fry Reglet Corp./Springlok System.
 - b. W.P. Hickman Co./The Leading-Edge Drive Lock System.
 - c. Substitutions: Refer to Section 01 25 00.

- E. Solder and Fasteners: As recommended by SMACNA and complying with applicable codes and regulations; hot dipped galvanized minimum coating comparable to G90.
- F. Concealed Sealant: Butyl type for use in conjunction with sheet metal; non-staining; non-corrosive; non-shrinking and non-sagging; ultra-violet and ozone resistant for exterior concealed applications.
- G. Bituminous Paint: Acid and alkali resistant type; black color; asbestos free.
- H. Plastic Cement: Cutback asphaltic type; asbestos free.
- I. Sealing Compound: Type recommended by roofing manufacturer; asbestos free.
- J. Gaskets: Type suitable for use in conjunction with sheet metal; non-staining, non-corrosive, non-shrinking, non-sagging, ultra-violet resistant, and ozone resistant; for exterior concealed applications.
 - 1. Manufacturers:
 - a. Emseal USA, Inc./Emseal MST Multi-Use Sealant Tape.
 - b. Substitutions: Refer to Section 01 25 00.

2.2 FABRICATION

- A. Fabricate sheet metal in accordance with SMACNA Architectural Sheet Metal Manual.
- B. Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
 - 1. Fabricate corners and intersections in shop with solder joints; watertight fabrication.
- C. Form sections in maximum 10'-0" lengths; make allowance for expansion at joints.
- D. Hem exposed edges on underside 1/2".
- E. Back-paint flashings with heavy bodied bituminous paint where in contact with cementitious materials or dissimilar metals.
- F. Form pitch pans watertight, with minimum 4" upstand and 4" flanges; form pans minimum 6" wider than item passing through roof membrane.
- G. Form umbrella flashings with minimum 2" overhang, to shed water away from pitch pans.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install metal flashing and sheet metal in accordance with SMACNA Architectural Sheet Metal Manual.

1. Install tight in place, with corners square, surfaces true and straight in planes, and lines accurate to profiles as indicated on Drawings.
 2. Lap joints in direction of water flow.
 3. Hold downspouts in position, clear of wall, by hangers spaced not more than 10'-0" on center; securely fasten hangers to wall without exposed damage to wall surface.
- B. Exercise care when cutting materials on site, to ensure cuttings do not remain on finished surfaces.
- C. Provide expansion joints concealed within system.
- D. Use concealed fasteners, continuous cleat type, except where specifically approved by Architect.
1. Exposed fasteners may be used, where clearly indicated on shop drawings and approved by Architect, at areas not exposed at exterior walls nor in sight of interior spaces.
- E. Apply sealing compound at junction of metal flashing and felt flashing.
- F. Lock seams and end joints; fit flashing tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- G. Counter-flash mechanical and electrical items projecting through roof membrane.
- H. Install sealants where required to prevent direct weather penetration.
1. Install continuous gasket behind surface applied reglets.
- I. Completed installation shall be free of rattles, noise due to thermal and air movement, and wind whistles.
- J. Install pitch pans and fill with plastic cement.
- K. Install umbrella flashing with draw band collars with sheet metal sealant between penetrating item and flashing; use wood blocking at angle type penetrations and cover blocking with sealant.
- 3.2 CLEANING
- A. Remove protective coating from shop finished sheet metal when no longer required to protect roofing and flashing from construction.
- B. Touch-up scratched and damaged finish to match new; remove and replace sheet metal units that cannot be repaired to look identical to adjacent sheet metal when viewed from 15'-0" away.

END OF SECTION

SECTION 07 72 00

ROOF HATCHES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide manufactured roof hatches with integral support curb, operable hardware, counterflashing, and accessories as required for complete, weather-tight installation.
 - 1. Provide fall protection railings where indicated and as required by applicable regulations.
- B. Related Sections:
 - 1. Section 05 50 00: Ladder extenders for roof hatch access.
 - 2. Section 07 60 00: Flashing roof hatches to roof system.

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature.
- B. Shop Drawings: Clearly indicate general construction, configurations, jointing methods and locations when applicable, fastening methods and general details.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Babcock-Davis Hatchways, Inc.
- B. Bilco Company.
- C. Dur-Red Products, Red Plastic Co., Inc.
- D. Milcor, Inc.
- E. Nystrom Building Products.
- F. Substitutions: Refer to Section 01 25 00.

2.2 ROOF HATCHES

- A. System Description: Provide manufactured roof hatches, with integral support curb, operable hardware, counterflashing, and accessories.
- B. Roof Hatches:
 - 1. Type: Single leaf type.

2. Size: 3'-0" by 3'-6" unless otherwise indicated.
- C. Construction: Construct with full welded corner joints, insulated hatch lids, and insulated internal support curbs.
 1. Provide complete with integral counter-flashings to roof flashing system and flanges on support curb for anchorage to roof deck.
 2. Loading: Capable of supporting minimum 40-psf external loading and 20-psf internal loading pressure.
- D. Opening Hardware: Manufacturer's standard manually operating type.
 1. Capable of ensuring effortless control and smooth operation without causing damage to hatch or to roofing system.
 2. Capable of being opened from inside and outside.
 3. Complete with hold-open mechanism and inside padlock hasps.
- E. Fall Protection Integral Railings: Provide railings fixed to roof hatch curbs (not requiring additional penetration of roof assembly); comply with applicable code requirements; welded construction; cap exposed ends.
 1. Railing Design Requirements: Comply with applicable codes and regulations requirements but not less than lateral force of 50 lbs. /lin. ft. uniform load and 200 lbs. at any single point without permanent set or damage; ASTM E935.
 2. Rails: Seamless steel tube rails, 42" height above roof surface, 1-1/2" outside diameter, continuous railings conforming to applicable code and design requirements.

2.3 FABRICATION

- A. Fabricate roof hatches weather-tight, and free of visual distortions and defects.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install roof hatches in accordance with manufacturer's recommendations and instructions for complete, weather-tight installation.
- B. Coordinate with installation of roofing system and related flashings.
- C. Apply bituminous paint on metal surfaces of roof hatches to be in contact with cementitious materials and dissimilar metals.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide firestopping as required to maintain effective barrier against spread of flame, smoke and gases, and to retain integrity of time-rated construction as indicated and at following types of locations.
 - 1. Provide at fire rated system perimeters, and at duct, conduit, piping penetrations through time-rated construction, and as required by applicable codes.
 - 2. Coordinate requirements for firestopping with work involving penetrations through fire rated assemblies.
 - 3. Review Project and Contract Documents to ascertain extent of penetrations in fire rated assemblies and methods included in other sections for maintaining fire ratings.
- B. Related Sections:
 - 1. Section 07 90 00: Non-fire rated joint sealants.
 - 2. Section 07 95 00: Expansion joint cover assemblies including integral firestopping.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate firestopping with fire rated assemblies and penetrations through fire rated assemblies to ensure compliance with applicable codes and regulations to maintain integrity of fire rated assemblies.
 - 1. Firestopping may be integral with some systems and may be specified as part of other systems including mechanical and electrical systems.
- B. Coordination with Acoustical Assemblies: Where a firestopping sealant is required at a penetration of an acoustical assembly, provide a fire-rated acoustical sealant such as Pecora/AC-20 FTR, or Hilti/CP 606.
 - 1. Do not use intumescent firestopping at acoustically rated assemblies.
 - 2. Coordinate with Section 09 21 00 – Gypsum Board Assemblies.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's literature including data for materials and prefabricated devices, including descriptions to identify materials and devices on job.
 - 1. Submit Underwriter's Laboratory approval numbers for required fire ratings; approval of other laboratories contingent upon acceptance of applicable authorities.

2. Deferred Approvals: Submit data necessary for applicable authorities for each type of firestopping required including firestopping at fire rated assembly junctures, and penetrations through fire rated assemblies.
 - B. Shop Drawings: Submit manufacturer's installation details.
 - C. Certificates of Compliance: Submit manufactures' certificates, accompanied by classifications, indicating material or combination of materials used meets requirements specified for flame spread and fire resistance.
 1. Certificates to be supported by test reports by nationally recognized testing authority or otherwise satisfactory to authorities.
 - D. Manufacturer's Instructions: Maintain copy of manufacturer's installation instructions and recommendations at each work area.
- 1.4 QUALITY ASSURANCE
- A. Sustainability Requirements: Comply with CALGreen requirements relative to finish material pollution control for sealants.
- 1.5 DELIVERY, STORAGE, AND HANDING
- A. Deliver materials in their original unopened packages and store in location providing protection from damage and exposure to elements.
 - B. Damaged or deteriorated materials shall be removed from site.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. AD Fire Protection Systems/AD Firebarrier Firestopping Materials.
- B. Hilti, Corp./Hilti Firestop Systems.
- C. 3M Fire Protection Products Div./3M Fire Barrier Products.
- D. Specified Technologies, Inc. (STI)/SpecSeal and Pensil Firestopping.
- E. Tremco/Firestopping Products.
- F. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide firestopping as required to maintain effective barrier against spread of flame, smoke and gases, and to retain integrity of time-rated construction.
 1. Choose products and methods meeting applicable codes and Specification requirements for each firestopping application, subject to Architect's acceptance.

- B. Regulatory Requirements: Comply with California Building Code, Chapter 7 requirements for firestopping, including both F Ratings and T Ratings as applicable.
- C. Design Requirements: Provide materials tested in accordance with following standards, unless otherwise specified.
 - 1. American Society for Testing and Materials (ASTM) Publications:
 - a. ASTM E84, Surface Burning Characteristics of Building Materials.
 - b. ASTM E119, Fire Tests of Building Construction and Materials.
 - c. ASTM E814, Fire Tests of Through-Penetration Fire Stops.
 - d. ASTM E1966, Test Method for Fire-Resistive Joint Systems.
- D. Firestopping Materials: Furnish materials for penetrations in time-rated floor, wall, and partition assemblies capable of preventing passage of flame, smoke, and hot gases.
 - 1. Penetration Test: Furnish materials passing ASTM E814 or E1966 for penetration fire stopping indicating maintenance of time-rated adjacent assemblies.
 - a. Additional Tests: Where required by applicable authorities, provide materials passing ASTM E119 time-temperature fire conditions for fire ratings indicated for assemblies.
 - 2. Flame Spread: ASTM E84 flame spread rating of 25 or less.
 - 3. Smoke Developed: ASTM E84 smoke developed rating of 450 or less.
- E. Firestopping: Maintain fire rating of assembly in which firestopping is installed, such as floor, partition, or wall, in accordance with ASTM E119 tests.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces and conditions receiving or affecting the work. Do not proceed until unsuitable conditions are corrected.

3.2 INSTALLATION

- A. Install firestopping in accordance with manufacturer's recommendations and installation instructions.
- B. Completely fill void space with firestopping materials regardless of geometric configuration, subject to tolerances established by firestopping manufacturer.
- C. Apply firestopping materials at penetrations of pipes, conduits, and ducts prior to application of insulation.
 - 1. Remove insulation already in place at penetration prior to application of firestopping materials unless insulation meets requirements for fire ratings indicated.

3.3 FIELD QUALITY CONTROL

- A. Inspection: Keep area of work available for inspection by Architect and applicable authorities before and after application of firestopping.

3.4 REPAIR AND CLEAN-UP

- A. Repair damage caused by work of this section; clean exposed surfaces soiled by work and leave work ready to receive following work.
- B. On completion of work, remove debris, excess materials, and equipment from site.

END OF SECTION

SECTION 07 90 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide joint sealants, for interior and exterior joints not specified elsewhere, with backing rods and accessories as required for complete installation.

1. Joint sealants include joint sealers and calking as indicated.

- B. Related Sections:

1. Section 07 60 00: Flashing and sheet metal concealed sealants.
2. Section 07 84 00: Firestopping type joint sealants.
3. Section 08 80 00: Glazing sealants.
4. Section 09 21 00: Sealants used for acoustical treatment at gypsum board.

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's descriptive literature.
- B. Samples: Furnish samples of each type of exposed joint sealer in required colors.
- C. Certifications:
1. Furnish manufacturer's certification joint sealers comply with Contract Documents and are suitable for Project applications.
2. Furnish certification indicating installers are trained in proper use of specified products, qualified, and familiar with proper installation techniques.

1.3 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives, sealants, and caulks.
1. Provide joint sealants as required by applicable codes and regulations to fill joints and openings in building envelope separating conditioned space from unconditioned space.
- B. Installer Qualifications: Firm with minimum five years successful experience on projects of similar type and size, using specified products.
- C. Installers shall be familiar with proper application procedures to ensure maximum joint sealer expansion and contraction capabilities.
- D. Mock-Up: Provide exterior joint sealers where required for mock-ups of other systems.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, cure time, and mixing instructions.

1.5 SITE CONDITIONS

- A. Do not proceed with installation of joint sealers under unfavorable weather conditions.
- B. Install elastomeric sealants when temperature is in lower third of temperature range recommended by manufacturer.

1.6 WARRANTY

- A. Extended Correction Period: Extend correction period to two years.
 - 1. Repair or replace joint sealers which fail to perform as intended, because of leaking, crumbling, hardening, shrinkage, bleeding, sagging, staining, loss of adhesion, and loss of cohesion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Description: Provide joint sealants with backing rods and accessories.
- B. Performance Requirements:
 - 1. Select materials for compatibility with joint surfaces and indicated exposures.
 - 2. Where not indicated, select modulus of elasticity and hardness or grade recommended by manufacturer for each application indicated.
 - 3. Comply with applicable limitations on volatile organic compound (VOC) emissions.
- C. Regulatory Requirements: Comply with applicable regulatory requirements regarding limitations on volatile organic compound (VOC) emissions limitations.
- D. Elastomeric Sealants:
 - 1. Single Component Low Modulus Silicone Sealant: ASTM C920 Type S, Class 25, Grade NS; minimum 50% expansion and compaction capability.
 - a. Provide at exterior locations not exposed to traffic.
 - b. Manufacturers:
 - 1) GE (Momentive Performance Materials)/Silpruf, Silglaz or GESIL.
 - 2) Dow Corning Corp./790 or 795.
 - 3) Pecora Corp./864 Architectural Silicone.
 - 4) Tremco/Spectrem 3.
 - 5) Substitutions: Refer to Section 01 25 00.

2. Multi-Component Polyurethane Sealant: ASTM C920, Type M, Grade NS, Class 25, non-sag; minimum 25% expansion and compaction capability.
 - a. Provide at exterior locations not exposed to traffic.
 - b. Manufacturers:
 - 1) Pecora Corp./Dynatrol II.
 - 2) Tremco/Dymeric 240.
 - 3) BASF/MasterSEal NP 2.
 - 4) Substitutions: Refer to Section 01 25 00.
3. Single Component Low Modulus Sealant: ASTM C920 Type S, Class 35, Grade NS; minimum 50% expansion and compaction capability.
 - a. Provide at exterior locations not exposed to traffic.
 - b. Manufacturers:
 - 1) Fortifiber Building Systems Group/Moistop Sealant.
 - 2) Sika Group/SikaFlex 1A+.
 - 3) Substitutions: Refer to Section 01 25 00.
4. Multi-Component Polyurethane Sealant: ASTM C920, Type M, Grade P, Class 25, self-leveling; minimum 25% expansion and compaction capability.
 - a. Provide at traffic bearing locations.
 - b. Manufacturers:
 - 1) Pecora Corp./Urexpan NR-200, or Dynatrol II-SG.
 - 2) Tremco/THC 900-901, or Vulkem 445 SSL.
 - 3) BASF/MasterSeal SL 2
 - 4) Substitutions: Refer to Section 01 25 00.
5. Mildew-Resistant Silicone Rubber Sealant: ASTM C920, Type S, Grade NS, Class 25, compounded with fungicide, specifically for mildew resistance and recommended for interior joints in wet areas.
 - a. Provide at interior joints in wet areas.
 - b. Manufacturers:
 - 1) GE (Momentive Performance Materials)/SCS 1702 Sanitary Sealant.
 - 2) Dow Corning Corp./786 Bathtub Caulk.
 - 3) Pecora Corp./898 Sanitary Mildew Resistant Sealant.
 - 4) Tremco/Tremsil 200.
 - 5) Substitutions: Refer to Section 01 25 00.

E. Non-Elastomeric Sealants:

1. Acrylic-Emulsion Sealant: ASTM C834 acrylic or latex-rubber-modified acrylic sealant, permanently flexible, non-staining and non-bleeding; recommended for general interior exposure; compatible with paints specified in Section 09 90 00.
 - a. Provide at general interior applications.
 - b. Manufacturers:
 - 1) Pecora Corp./AC-20.
 - 2) Tremco/Tremflex 834.
 - 3) Substitutions: Refer to Section 01 25 00.
2. Air Seals: Provide non-staining and non-bleeding sealers, calks, or foams appropriate to specific applications for filling openings between conditioned and unconditioned spaces.
 - a. Type: As recommended by manufacturer for each specific application; compatible with adjacent materials.
 - b. Manufacturers:
 - 1) Dow/Great Stuff.
 - 2) Owens Corning/EnergyComplete Air Sealant.
 - 3) Hilti/Foam Filler CF 812.
 - 4) Substitutions: Refer to Section 01 25 00.
 - c. Pest Control Mesh: Openings subject to pest infiltration to have 304 stainless steel wool, material stuffed in joint before application of air seals using methods to ensure blocking of gap from pests.
 - d. Exception: Annular spaces around pipes, electric cables, conduits and other openings in exterior walls shall be protected against passage of rodents by closing with cementitious grout.
 - 1) Cementitious Grout: ASTM C1107 non-shrink, non-metallic, pre-mixed, factory-packaged, non-staining, non-corrosive; type specifically recommended by manufacturer as applicable to job condition.

F. Miscellaneous Materials:

1. Primers/Sealers: Non-staining types recommended by joint sealer manufacturer for joint surfaces to be primed or sealed.
2. Joint Cleaners: Non-corrosive types recommended by joint sealer manufacturer; compatible with joint forming materials.
3. Bond Breaker Tape: Polyethylene tape as recommended by joint sealer manufacturer where bond to substrate or joint filler must be avoided for proper performance of joint sealer.

4. Sealant Backer Rod: Compressible polyethylene foam rod or other flexible, permanent, durable non-absorptive material as recommended by joint sealer manufacturer for compatibility with joint sealer.
 - a. Oversize backer rod minimum 30% to 50% of joint opening.
- G. Colors: As indicated, as selected by Architect from manufacturer's full range of colors where not indicated.
 1. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare joint surfaces in accordance with ASTM C1193 and as recommended by joint sealer manufacturer.
- B. Clean joint surfaces immediately before installation of joint sealer; remove dirt, insecure materials, moisture and other substances which could interfere with bond of joint sealer.
- C. Prime or seal joint surfaces where recommended by joint sealer manufacturer; do not allow primer/sealer to spill or migrate onto adjoining surfaces.
- D. Ensure protective coatings on surfaces in contact with joint sealers have been completely stripped.

3.2 INSTALLATION

- A. Comply with manufacturer's printed instructions and ASTM C1193, except where more stringent requirements are shown or specified.
- B. Pest Control: Install stainless steel wool prior to application of backer rods and bond breakers at air seal and as required to ensure complete pest blockage at joints where pest intrusion is a potential.
- C. Set sealant backer rods at proper depth or position in joint to coordinate with other work, including installation of bond breakers and sealant; do not leave voids or gaps between ends of backer rods.
 1. Do not stretch, twist, puncture or tear backer rods.
- D. Install bond breaker tape as required to avoid three-sided bond of sealant to substrate and where required by manufacturer's recommendations to ensure joint sealers will perform properly.
- E. Size materials to achieve required width/depth ratios.
- F. Employ installation techniques that will ensure joint sealers are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of bond surfaces equally on opposite sides.

- G. Joint Configuration: Fill sealant joint to a slightly concave surface, slightly below adjoining surfaces, unless otherwise indicated.
- H. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove, so that joint will not trap moisture or dirt.
- I. Install joint sealers to depths recommended by joint sealer manufacturer but within the following general limitations, measured at center (thin) section of bead.
 - 1. Horizontal Joints: 75% width with minimum depth of 3/8".
 - 2. Elastomeric Joints: 50% width with minimum depth of 1/4".
 - 3. Non-Elastomeric Joints: 75% to 125% of joint width.
- J. Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces.
 - 1. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.
- K. Cure joint sealers in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength and surface durability.
- L. Maintain finished joints free of embedded matter, ridges and sags.

END OF SECTION

SECTION 07 95 00

EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide shop fabricated elastomeric expansion joint cover assemblies, metal and elastomeric types as indicated, including anchors and accessories as required for complete installation.
 - 1. Provide weather-tight exterior joint cover assemblies, with metal retainers, including anchors and accessories as required for complete installation.
 - 2. Expansion joint cover assemblies include both expansion and compression assemblies as indicated on Drawings.
- B. Related Work:
 - 1. Section 07 60 00: Flashing and sheet metal.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Meeting: Convene not less than one week prior to commencing work of this Section. Require attendance of those directly affecting work of this Section.
 - 1. Review installation procedures and coordination required with related work.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's literature for each joint cover assembly.
- B. Shop Drawings: Indicate method of connection to structure.
- C. Samples: Submit samples of each type of exposed finish material.
- D. Certificates: Submit manufacturer representative's certification indicating exterior joint cover assemblies have been installed in accordance with manufacturer recommendations and instructions.

1.4 WARRANTY

- A. Extended Correction Period: Provide for correcting failure of exterior expansion and compression joint cover assemblies to resist wind and to maintain weather-tight closure under anticipated movement and conditions.
 - 1. Period: Two years.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Inpro Corp. JointMaster Systems. **(Basis of Design)**
- B. Balco Inc.
- C. Construction Specialties, Inc. C-S Group.
- D. Nystrom Building Products.
- E. MM Systems, Inc.
- F. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide shop fabricated elastomeric expansion joint cover assemblies, metal and elastomeric types as indicated, including anchors and accessories.
 - 1. Provide each type of joint cover assembly as a system from a single manufacturer; provide exterior wall and roof joint cover assemblies from a single manufacturer.
 - 2. Provide factory fabricated connection between exterior wall and roof joint covers.
- B. Regulatory Requirements, Fire and Smoke: Provide systems listed or certified by Underwriters Laboratories (UL), or similar independent testing laboratory accepted by applicable authorities.
 - 1. Fire Rated Assemblies: Provide complete assemblies complying with applicable code requirements for fire ratings matching adjacent construction, and matching construction of listed or approved rated assemblies.
 - 2. Smoke Barriers: Provide fire rated assemblies capable of providing smoke barrier in accordance with applicable code requirements.
- C. Regulatory Requirements, Slip-Resistance: For assemblies at walking surfaces.
 - 1. Slip-Resistant Hard Surfaces: Hard surface finishes to comply with requirements of authorities having jurisdiction for slip-resistant hard surfaces, including general code requirements and requirements for access for persons with disabilities.
- D. Aluminum: ASTM B221 alloy 6063-T5 for extrusions; ASTM B209, alloy 6061-T6, sheet and plate
 - 1. Metal Finishes:
 - a. Aluminum Contact Surfaces on Concrete: Zinc chromate primer.
 - b. Aluminum Floor Covers: Mill finish.
 - c. Aluminum Covers, Other Than Floors: Clear anodic coating.

2. Wearing Surfaces: Manufacturer's standard, of type shown on Drawings.
3. Protection: Cover exposed metal surfaces with factory-applied adhesive paper or polyvinyl chloride (PVC) protective strippable coating.
- E. Elastomeric Seals: Manufacturer's standard durometer consistent with joint size and application.
 1. Functional Seal: ASTM C509 closed cell neoprene as recommended by manufacturer for application indicated and as needed to assure weathertight exterior applications.
 2. Visual Seals: ASTM C864 dense silicone.
 3. Lubricants/Adhesives: Type as recommended by system manufacturer for specific material and application.
 4. Sealants at Elastomeric Seals: Type as recommended by seal manufacturer to maintain integrity of weather barrier.
 5. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- F. Compression Seals: Premium quality neoprene, manufacturer's standard durometer consistent with joint size and application.
 1. Lubricant/Adhesive: Manufacturer's standard.
 2. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- G. Accessories: Manufacturer's standard anchors, fasteners, set screws, spacers, flexible seal and filler materials, adhesive and accessories compatible with material in contact.
 1. Exterior Anchors: Minimum Series 300 stainless steel.
 2. Elastomeric Seal Corner Angle Reinforcing: Minimum Series 304 stainless steel.

2.3 FABRICATION

- A. General: Furnish basic profile and operating units for expansion joint covers as indicated on Drawings.
 1. Expansion and Compression Joint Cover Types: As indicated and as approved by Architect.
- B. Shop Assembly: Assemble items in shop to minimize field splicing and assembly of units at Project site.
- C. Furnish longest practicable lengths to minimize number of end joints.

1. Seals: Continuous between intersections with joints mitered, reinforced with stainless steel angles, and sealed with joint sealer.
 2. Functional Seals: Continuous where possible.
 3. Intermediate Drains: Provide at exterior joint cover assemblies as required to allow water to drain to exterior.
 4. Interior Seals: Continuous between intersections with joints mitered. Reinforce joints with stainless steel angles.
- D. Provide hairline mitered corners where joint changes direction or abuts other material systems.
- E. Provide factory fabricated custom fit end closers at exposed ends of joint cover assemblies.
- F. Provide separator coat between aluminum and dissimilar materials to prevent electrolysis and to protect aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible.
1. Allow for trimming and fitting wherever taking of field measurements before fabrication might delay work.
 2. Furnish setting drawings for installation of anchorages to be embedded in adjacent construction; coordinate delivery of such items to Project site so as to prevent delay of construction.
- B. Examine areas and conditions under which expansion joint covers are to be installed.
- C. Coordinate with adjacent systems to ensure acceptable conditions for installation of expansion joint cover assemblies.
- D. Do not proceed with work until unsatisfactory conditions have been corrected, start of installation indicated acceptance of conditions.

3.2 INSTALLATION

- A. Manufacturer's Instructions: Comply with manufacturer's instructions and recommendations, including preparation of substrate, applying materials and protection of installed units.
1. Fire Rated Assemblies: Install assemblies using materials and methods as required to provide fire resistant rating matching adjacent material and assembly ratings.
- B. Cutting, Fitting and Placement:

1. Perform cutting, drilling and fitting required for installation.
2. Set work accurately in location, alignment and elevation, plumb, level, true, measured from established lines and levels.
3. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.
4. Install joint cover assemblies in true alignment.
5. Locate wall, ceiling, and soffit covers in continuous contact with adjacent surfaces; securely attach in place.
6. Hold end joints to minimum; make end joints with strong, rigid, mechanical splice plate in true alignment, with hairline joints.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Manufacturer's representative to visit site and provide written certification indicating exterior expansion joint covers have been installed in accordance with manufacturer recommendations and instructions.
- B. Exterior Joint Covers Water Test: Clean intermediate drains and test to ensure water does flow through expansion joint cover drainage system and is properly directed to building drainage or to building exterior.

3.4 CLEANING AND PROTECTION

- A. Do not remove strippable protective material until finish work in adjacent areas is complete.
- B. When protective material is removed, clean exposed metal surfaces in accordance with manufacturer's instructions.

END OF SECTION

SECTION 08 11 10

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide full flush steel (hollow metal) doors and pressed steel frames, including anchors and silencers.

1. Pressed steel frames

- B. Related Sections:

1. Section 08 11 25: Interior aluminum doors and frames.
2. Section 08 71 00: Door hardware.
3. Section 08 80 00: Glazing.

1.2 REFERENCES

- A. Steel Door Institute (SDI): SDI-100 (ANSI/SDI A250.8) - Recommended Specifications - Standard Steel Doors and Frames.
B. National Association of Architectural Metal Manuf. (NAAMM): Hollow Metal Manual.
C. Underwriters Laboratories: Standards as applicable to fire rated doors and frames.
1. Materials tested, labeled and inspected by Warnock Hersey International are acceptable upon approval of authorities.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. Coordinate hardware installation with Section 08 71 00 – Door Hardware.
2. Coordinate glass installation with Section 08 80 00 - Glazing.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturers' literature.
B. Shop Drawings: Indicate general construction, configuration, jointing methods, reinforcement, anchorage methods, hardware locations, and locations of cut-outs.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Amweld Building Products Inc.

- B. Ceco Door Division Assa Abloy Door Group.
- C. Curries Division Assa Abloy Door Group.
- D. Door Components, Inc.
- E. Republic Doors and Frames.
- F. Krieger Steel Products Co.
- G. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide full flush steel (hollow metal) doors and pressed steel frames, including anchors and silencers.
- B. Doors: Hollow metal flush steel door, 1-3/4" thick.
 - 1. Typical: Full flush with steel channel or welded edge; close top with flush end closer treatment, bottom optional flush or recessed channel; steel stiffened core, insulated at exterior doors; continuous welded seam.
 - 2. Interior Doors: Minimum 0.042" (18-gage).
 - 3. Exterior Doors: Minimum 0.053" (16-gage).
 - 4. Glazed and Louver Doors: Provide systems as indicated on Drawings.
- C. Frames:
 - 1. Exterior Frames: Welded (pre-assembled) type.
 - 2. Interior Frames: Knockdown (field-assembled) type; provide 3/8" back bend return on frames at gypsum board.
 - 3. Gage: Minimum 0.053" (16-gage) interior frames, 0.067" (14-gage) exterior frames.
 - 4. Door Silencers: Manufacturer's standard resilient type; removable for replacement.
 - 5. Mortar Guard Boxes: Minimum 0.026" (22-gage) mortar guard boxes welded in place; provide where frames may be grouted.
- D. Glazing Stops: Full flush type with glass centered in opening, unsecured side integral with unit, secured side fastened with flush, countersunk Allen type fasteners; minimum 0.053" (16-gage).

- E. Fire Rated Units: Construct in accordance with requirements for fire rating, NFPA 252 or UL 10C, and NFPA 80.
 - 1. Labels: Place fire rating labels where visible when doors and frames are in installed, opened position.
 - 2. Fire Ratings: Refer to Drawings for fire rating requirements.
 - 3. Temperature Rise Rating: Provide doors with maximum 450°F Temperature Rise Rating in 30-minute fire exposure period at doors into exit enclosures and where otherwise required by applicable codes.
- F. Door Louvers:
 - 1. Interior Doors: Stationary, sight-proof hood or Y type blades of 24-gage steel inserted into door panels full door thickness; no exposed trim.
 - 2. Exterior Doors: Weatherproof Z-shaped blades with U-shaped frames; 1-3/8" thick; blades 1-1/2" on center; 0.053" (16 gage) welded construction.
 - a. Provide removable bird screens on interior faces, 1/2" by 1/2" bronze wire mesh.

2.3 FABRICATION

- A. Conform to requirements of SDI (ANSI A250 Series) or NAAMM.
- B. Reinforce and prepare doors and frames to receive hardware.
 - 1. Refer to Section 08 71 00 for hardware requirements.
- C. Frames:
 - 1. Welded Frames: Accurately form and cut mitered corners of welded type frames; continuously weld on inside surfaces (fully welded); grind welded joints to smooth uniform finish.
 - 2. Knocked Down Frames: Accurately form and miter interlocking joints of knocked down frames to maintain hairline alignment of parts when field assembled.
 - 3. Head Reinforcement: Reinforce frames wider than 4'-0" with minimum 0.093" (12 gage) formed steel channels welded in place, flush with top of frames.
 - 4. Doors at Glazed Panels: Reinforce jambs and heads of frames for doors which occur adjacent to glazed sidelights and partitions.
- D. Door Silencers:
 - 1. Place three single bumpers on single door frames; space equally along strike jambs.
 - 2. Place two single bumpers on double door frames; place on frame heads.

3. Place three single bumpers for each door on door frames with removable mullions, spaced equally along strike jambs, and in addition place two single bumpers on frame heads to cushion door when mullion is removed.
- E. Provide jamb anchors per SDI-100 (ANSI/SDI 250.8) and NAAMM; weld floor jamb anchors in place.
- F. Provide double doors tested and approved without astragals.
 1. Provide astragals for double doors when required to meet UL requirements for Class A, 3-hour rated doors only.
- G. Edge Clearances:
 1. Between Doors and Frames: Maximum 1/8" at head and jambs.
 2. Door Sills (No Threshold): Maximum 1/2".
 3. Door Sills (Threshold): Maximum 3/8" above finished floor.
 4. Between Edges of Pairs of Doors: Maximum 1/8".
 5. Fire Rated Doors: As required for fire ratings.
- H. Finish: Comply with requirements of Section 09 90 00 – Painting and Coating for primer including application and compatibility with specified finishes.
 1. Interior Units: Prime paint.
 2. Exterior Exposed Units: Apply minimum A60 non-spangle galvanized coating, ASTM A924 and A653.
 - a. Surface treat after galvanizing to remove oils and prepare for painting and apply one coat of primer; comply with requirements in Section 09 90 00.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install doors and frames in accordance with SDI-100 (ANSI/SDI A250.8) and ANSI/SDI A250.11 or NAAMM "Hollow Metal Manual" and with manufacturer's recommendations and installation instructions.
 1. Install fire rated units in conformance with fire label requirements and NFPA 80.
- B. Install doors and frames plumb and square within 1/16", and with maximum diagonal distortion of 1/32".
- C. Remove and replace doors and frames damaged during delivery, storage, installation and construction.
 1. Paste filler repair shall not be permitted.
- D. After installation, touch-up scratched paint surfaces.

END OF SECTION

SECTION 08 11 20

INTERIOR ALUMINUM FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide aluminum frames for interior doors and glazed partitions, with attachments and accessories as required for complete installation.
 - 1. Prepare frames for door hardware.
- B. Related Work:
 - 1. Section 08 71 00: Door hardware.
 - 2. Section 08 80 00: Glazing.

1.2 REFERENCES

- A. Underwriters Laboratories Inc. (UL): Building Materials Directory.
 - 1. Materials tested, labeled and inspected by Warnock Hersey International are acceptable upon approval of authorities.
- B. National Association of Architectural Metal Manuf. (NAAMM): Metal Finishes Manual.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate hardware installation with Section 08 71 00 - Door Hardware.
 - 2. Coordinate glass installation with Section 08 80 00 - Glazing.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's literature.
- B. Shop Drawings: Indicate pertinent dimensioning, general construction, component connections and locations, anchor methods and locations.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Wilson Partitions.
- B. Western Integrated Materials, Inc.
- C. RACO Interior Products.
- D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide aluminum frames for interior doors and glazed partitions, with attachments and accessories.
- B. Interior Aluminum Frames: Knock-down (field assembled) door frames; extruded aluminum, ASTM B221, 6063-T5 alloy; profile as indicated.
 - 1. Glazed Partition Frames: Provide extruded aluminum security type snap-in glass stops.
 - 2. Door Stop Gasketing: Provide continuous elastomeric vinyl gasketing at door stop.
- C. Anodized Finish: Manufacturer's standard anodized finish conforming to NAAMM Manual requirements for anodizing, Class I and Class II acceptable.
 - 1. Color: Clear anodized unless otherwise indicated.

2.3 FABRICATION

- A. Fabricate aluminum frames to allow for clearances and shim spacing around perimeter; provide for thermal movement.
- B. Provide anchorage devices to securely and rigidly fit frames in place.
 - 1. Conceal anchorage devices and fasteners.
- C. Accurately fit together joints and corners; match components ensuring continuity of line and design; ensure joints and connections are flush, hairline and weatherproof.
- D. Provide required internal reinforcing for door hardware.
 - 1. Refer to Section 08 71 00 for hardware requirements.
- E. Apply coat of bituminous paint on concealed aluminum surfaces to be in contact with cementitious or dissimilar materials.
- F. Exposed Anodized Surfaces: Apply clear lacquer protective coating, minimum 5 mils dry thickness; conform to AAMA 606.2.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install aluminum frames in accordance with recommendations of manufacturer.
 - 1. Install fire rated units in conformance with fire label requirements and NFPA 80.
- B. Ensure assemblies are plumb, level and free of warp or twist; maintain dimensional tolerances and alignment with adjacent work.
- C. Use anchorage devices to securely and rigidly fasten frame assemblies to building.

- D. After installation, touch-up scratched and damaged surfaces; remove and replace damaged frames where touch-up is noticeable from 5'-0" or more.

END OF SECTION

SECTION 08 14 00

WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide flush wood doors as indicated.
 - 1. Contractor Option: Provide shop finished wood doors.
- B. Related Work
 - 1. Section 08 11 20: Interior aluminum frames.
 - 2. Section 08 71 00: Door hardware.
 - 3. Section 08 80 00: Glass and glazing for wood doors.

1.2 REFERENCES

- A. North American Architectural Woodwork Standards – 3.1, (NAAWS).
- B. Window and Door Manufacturer's Association (WDMA): Guide Specifications.
- C. Underwriters Laboratories Inc. (UL): Building Materials Directory.
 - 1. Materials tested, labeled and inspected by Warnock Hersey International are acceptable upon approval of authorities.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Wood Jambs: Coordinate with Section 06 20 00 – Finish Carpentry for prefit wood doors for door jambs.
 - 2. Hardware: Coordinate hardware installation with Section 08 71 00 – Door Hardware.
 - 3. Glazing: Coordinate glazing with Section 08 80 00 – Glazing.
 - 4. Painting: Coordinate with Section 09 90 00 – Painting and Coating whether wood doors are to be shop finished or field painted.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's literature.
- B. Shop Drawings: Indicate general construction, jointing methods, hardware locations, and locations of cut-outs.

- C. Samples: Submit samples of wood doors indicating construction, veneering, and finish.
 - 1. Submit shop finish for wood doors where doors are furnished shop finished.
- D. Certificates: Submit manufacturer certification indicating compliance to applicable requirements of either NAAWS or WDMA Standards; note which standards were followed or if both standards have been met.
 - 1. Wood Product Certification: Furnish certification indicating wood products are from FSC "well-managed" forests.

1.5 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for composite wood products formaldehyde limitations and paints and coatings.

1.6 SITE CONDITIONS

- A. Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized in accordance with referenced standards requirements applicable to Project location.

1.7 WARRANTY

- A. Extended Correction Period: Provide for replacing, rehanging, and refinishing wood doors exhibiting defects in materials or workmanship including warp and delamination.
 - 1. Period: Two years.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Algoma Hardwoods, Inc.
- B. Eggers Industries Architectural Door Division.
- C. Marshfield Door Systems, Inc.
- D. VT Industries. (Basis of Design)
- E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide flush wood doors as indicated.

- B. Solid Core Flush Wood Doors: NAAWS/Premium Grade, 5 Ply Hot Press, 1-3/4" thick solid wood framed glued block construction or particleboard core five ply construction; Contractor option to use WDMA comparable standards.
 - 1. Transparent/Stained Wood Veneers: NAAWS/Premium Grade veneers for transparent/stained finish; nominal 1/40" thick before sanding, not less than 1/50" after sanding.
 - a. Wood Veneers: Types as indicated, as directed by Architect where not otherwise indicated.
 - 2. Edges: Stile edges to match face veneer, minimum 1-1/8" thick after trim.
 - 3. Core: Bond stiles and rails to core and sand prior to assembly of face veneers.
 - 4. Bond Type: Provide Type I Bond for exterior doors, Type II Bond for interior doors.
 - 5. Bond Type: Provide Type II Bond for interior doors.
 - 6. Fire Rated Flush Wood Doors: 1-3/4" thick, match non-rated door appearance; comply with applicable codes; UL or Warnock Hersey rated.
 - a. Labels: Place fire rating labels where visible when doors are installed, in opened position.
 - b. Fire Ratings: Refer to Drawings for fire rating requirements.
 - c. Core: Use wood core construction for 20 minute rated flush doors, mineral core permitted for longer ratings.
 - d. Temperature Rise Rating: Provide doors with maximum 450°F Temperature Rise Rating in 30-minute fire exposure period at doors into exit enclosures, for horizontal exits, and as required by applicable codes.
 - 7. Edges: Stile edges to match face veneer, minimum 1-1/8" thick after trim.
 - 8. Bond Type: Type II Bond, interior.

2.3 FABRICATION

- A. Fabricate doors in accordance with requirements of specified standards.
 - 1. Prefit wood doors.
 - 2. Prepare doors to receive hardware in shop, refer to Section 08 71 00 for hardware requirements and templates.
 - 3. Factory machine doors for mortise hardware.
- B. Bevel strike edge of single-acting doors, 1/8" in 2".
 - 1. Radius strike edge of double-acting swing doors 2-1/8".

- C. Fire Rated Doors: Fabricate fire rated doors in accordance with requirements of Underwriters' Laboratories (UL) or Warnock Hersey International.
 - 1. Provide fire rated doors with maximum allowable edge strips, of wood species to match face veneers.
 - 2. Provide doors with blocking designed for addition of closers, even where doors are not indicated to receive closers.
 - 3. Provide astragals and metal edge trim for double doors, in accordance with requirements for fire rated doors.
- D. Make cut-outs and provide matching wood stops for glass; profiles as indicated, type as selected by Architect where not otherwise indicated.
 - 1. Fire Rated Doors: Provide minimum 18-gage metal stops conforming to fire rating requirements.
- E. Shop Finished Doors (Contractor Option): Conform to requirements specified in Section 09 90 00 – Painting and Coating.
 - a. Colors:. Select Maple. Ravine RA 18 stain, VT Industries, Basis of Design.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood doors in accordance with manufacturer's recommendations and installation instructions, and reference standards, plumb and square, and with maximum diagonal distortion of 1/16".
 - 1. Install fire rated wood doors in accordance with requirements for specified fire label and requirements of NFPA 80.
 - a. Field cutting of fire rated doors shall not be acceptable.
- B. Rehang or replace doors which do not swing or operate freely.

3.2 PROTECTION

- A. Protection: Protect doors as recommended by door manufacturer to ensure doors are without damage at time of Substantial Completion.
 - 1. Shop Finished Doors: Refinish or replace damaged doors.

END OF SECTION

SECTION 08 31 00

ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide access doors set in finished surfaces.
 - 1. Provide access doors and panels as required for access to controls and valves behind finished surfaces.
 - 2. Coordinate with various trades for controls and valves which may be concealed.

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature.
- B. Shop Drawings: Indicate locations of access doors required but not indicated on Architectural Drawings.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Milcor Inc.
- B. Karp Associates, Inc.
- C. J.L. Industries.
- D. Nystrom Building Products.
- E. Elmdor Manufacturing Co.
- F. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide access doors and panels set in finished surfaces.
- B. Regulatory Requirements: Where doors and panels are in fire rated assemblies provide assemblies listed in Underwriters Laboratories, Inc. "Classified Building Materials Index" for rating shown.
 - 1. Provide UL label on each rated access door.
 - 2. Materials tested, labeled and inspected by Warnock Hersey International are acceptable upon approval of authorities.

- C. Access Doors and Panels: Provide access door and panel assemblies consisting of an integral unit with flush metal doors and panels, complete and ready for installation.
 - 1. Fire Rated Units: Match Milcor/Model UFR Universal flush panel fire rated doors.
 - 2. Wall Units: Match Milcor/Style M flush panel style; prime painted unless otherwise indicated.
 - 3. Units Mounted in Plaster: Match Milcor/Style K, flush panel style.
 - 4. Units Mounted in Adhered Acoustical Tile Ceilings: Match Milcor/Style AT recessed panel style to receive acoustical tile.
 - 5. Gypsum Board Ceilings: Match Milcor/Style ATR recessed panel style to receive gypsum board insert with edges filled and taped.
 - 6. Floor Doors: Match Milcor/Style FA flush steel plate.
- D. Frames: Fabricate from not less than 16-gage steel.
- E. Doors: Flush panel type, fabricate from not less than 14-gage steel.
- F. Hinges: Provide continuous piano type hinge.
- G. Locking Devices: Provide flush, key-operated cylinder lock for each access door; provide two keys per lock and key locks alike, unless otherwise scheduled.
- H. Finish: Finish with manufacturer's factory-applied enamel prime coat applied over phosphate coating on steel.
 - 1. Stainless Steel: Where indicated provide Type 304 corrosion resistant nonmagnetic stainless-steel access doors and frames.

2.3 FABRICATION

- A. Size Variations: Obtain Architect's acceptance of manufacturer's standard size units which may vary slightly from sizes shown or scheduled.
- B. Fabricate units of continuous welded steel construction; grind welds smooth and flush with adjacent surfaces.
- C. Provide attachment devices and fasteners of type required for specific job conditions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which access doors are to be installed.
 - 1. Do not proceed with work until unsatisfactory conditions are corrected; installation signifies acceptance of conditions.

- B. Obtain specific locations and sizes for required access doors from trades requiring access to concealed equipment; coordinate installation with work of other trades.

3.2 INSTALLATION

- A. Comply with manufacturer's installation instructions for access doors.
 - 1. Install fire rated access doors in accordance applicable code requirements and with requirements of NFPA 80.
- B. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.
- C. Adjust hardware and doors after installation for proper operation.

3.3 PROTECTION

- A. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 08 35 55

ACCORDION-FOLDING FIRE DOORS

PART 1 – GENERAL

1.01 SUMMARY OF WORK

- A. Division 0 and 1, as indexed, apply to this section.
- B. Furnish and install all horizontal-sliding accordion-folding fire doors shown on the drawings and specified herein.

1.02 RELATED SECTIONS

- A. All headers, support structures, fire protection of support structures, surrounding insulation, jambs, storage pockets, blocking and trim shall be furnished and installed by other sections.
- B. All electrical wire, wiring, conduit and electrical boxes shall be furnished and installed by electrical section including connections to smoke detectors and building fire and access control alarm panels.
- C. Drilling/placement of anchorage points, welding/ punching/drilling steel members and all drywall work by other sections.
- D. All track, soffit, chain guide and striker shall be painted by Section 09 90 00. Color shall be selected by the architect.
- E. Form C dry contact relays for supervisory, trouble, door status, and alarm condition located in the Won-Door controller, shall provide output signals for monitoring the door condition. For 2 additional output signal requirements, an XRM (Auxiliary Relay Module) will be included. A twisted pair of stranded 18-gauge copper conductors for each output is required from the Won-Door controller to the monitoring device location.

1.03 QUALITY ASSURANCE

- A. Installation shall be performed by factory trained and certified installers with experience installing electrically operated accordion folding fire doors.
- B. Fire doors shall be listed by Underwriters Laboratories for ratings as indicated, when tested in accordance with the requirements of UL 10B and NFPA 252.
- C. Automatic closing system shall be listed by Underwriters Laboratories in accordance with the requirements of UL 864 and UL 294, and in compliance with NFPA 80.
- D. Fire Doors shall be capable of resisting an air pressure differential up to 0.05 inches of water column. Optional air pressure resistance up to 0.15 inches of water column available. (See 2.05 H)

1.04 SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's technical literature, include UL listing data.

- C. Shop Drawings: Indicate construction and installation details and dimensions, including layout, electrical requirements, required stack depth, height of header above finished floor, and requirements for anchorage and support of each door.
- D. Operation and Maintenance Data: Operating procedures, troubleshooting and repair methods, and wiring diagrams.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Manufacturer's agent will deliver original, unopened packages to a location designated by the General Contractor. All packages must be stored indoors, protected from moisture damage and secure from theft or other damage. General Contractor to note any damage or shortages at time of delivery.

1.06 COORDINATION BY GENERAL CONTRACTOR

- A. Coordinate with the following:
 - 1. Fire Alarm system.
 - 2. Electrical.
 - 3. Pocket cover doors (if required).
 - 4. Floor and ceiling finish.
- B. Assure accurate installation of header, jamb, and trim. Provide "As-Built" dimensions for opening and storage pocket. Supervise unloading and handling of materials.
- C. Store boxes flat (not more than three high) in a protected dry area.
- D. Permanent power shall be in-place and ready for final connection when fire and access control doors are installed. Assure access to and proper clearance for motor operators.
- E. After testing the fire alarm system, automatic-closing fire doors shall be re-set to the original position.

1.07 WARRANTY

- A. Materials and installation shall be warranted against defects in workmanship for a period of two (2) years from the date of substantial completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Horizontal-sliding, accordion-folding, fire doors as manufactured by Won-Door Corporation shall be specified as the following:

Won-Door FireGuard 60 S Basis of Design

- B. Substitutions per division 01

2.02 ACCORDION FIRE DOORS – GENERAL

- A. Provide electrically powered self-closing fire doors of configurations indicated on the drawings.
 - 1. Fire rating as required.

- B. Fire Rating – Fire doors shall be listed by Underwriters Laboratory as special purpose fire doors having a (*select one*: 60 minute fire protection rating in accordance with the requirements of UL 10B and NFPA 252).
- C. Single Parting and Bi-Parting: Door opening can be configured in a single parting (pocket at one end) or bi-parting (pocket at both ends) condition.
- D. Closing and Opening Operation: Automatic Closing System, listed to UL864 including motor operator and releasing devices shall be a Microprocessor-based system and shall commence closing upon activation by fire signal, access control signal, low battery voltage or optional low AC voltage.
 - 1. Obstruction Detection: Contact with an obstruction shall cause the door to stop, reverse enough to remove pressure on the leading edge, pause, and then re-close when in an alarm condition.
 - 2. Constant pressure to the leading edge while not under motor power shall prevent motor operation and allow the door to be opened manually.
- E. Exit Device Operation: Provide an exit device on one or both sides of door.
 - 1. In emergency mode, a slight pressure on the exit device will cause the door to open a minimum of 32 inches, pause for 3 seconds, and then automatically close.
 - 2. The open distance shall be field programmable, up to the entire opening width.
 - 3. The pause before re-close shall be field programmable up to 30 seconds.
 - 4. The exit device shall have the ability when not in the emergency (fire) mode to be used to open the door and move it back into the storage pocket.

2.04 COMPONENTS

- A. Door Construction: Two parallel, accordion-type walls independently suspended with no floor tracks or pantographs.
 - 1. Panels: 24-gauge steel, V-grooved; modular in design; capable of in-place repair.
 - 2. Perimeter Seals: shall consist of continuous extruded sweeps attached to the top and bottom of the fire door to form a smoke and draft seal.
 - 3. Hanging Weight: 5.5 pounds per sq. ft when extended across opening.
 - 4. Finish: All steel panels shall have factory-applied protective coatings.
 - 5. Color: Manufacturer's standard platinum.
- B. Suspension System: Two tracks, on 8- or 10-inch centers, attached to overhead structural support.
 - 1. Track: 14-gauge cold rolled steel or 1/8" Aluminum extrusion.
 - 2. Panel Hangers: Panels shall be suspended by a steel hanger pin and ball bearing roller system.
 - 3. Narrow Lead Post Hangers: 8-wheel ball bearing trolley.
 - 4. Flat Lead Post Hangers: Double ball bearing rollers at each side with an 8-wheel ball bearing trolley.

- C. Power source shall be: 120-volt AC input. System operation voltage shall be dual sourced from DC power supply and backup battery.
- D. Automatic Closing System shall be listed to UL864 including capability to send and receive signals from the Fire Control Panel and shall consist of the following:
 - 1. Microprocessor based Electronic Control box with the ability to:
 - a. Monitor dual power sources continually for peak performance including:
 - 1) Detect a missing battery, bad battery, or low battery condition.
 - 2) Detect if the charging circuit is bad.
 - 3) Detect fuse failures.
 - 4) Detect high or low AC conditions.
 - b. Monitor the health of the drive train.
 - c. Monitor inputs including faults associated with door block, exit device, patron hardware, and key switches.
 - d. Run a “watch dog” monitoring circuit which will force a software restart in the event the software hangs, including tracking the number of resets that occur for diagnostic purposes.
 - e. Withstand aberrant voltages up to 120 volts AC on the fire alarm input circuit without damage including the ability to indicate that the alarm circuit has not been wired as a dry contact, “no voltage” circuit when errant voltages are applied to the circuit.
 - f. Communicate with other microprocessors on the system via an internal bus system.
 - g. Indicate faults or supervised information both locally and at a remote location.
 - 2. Motor Operator Assembly including a DC gear-motor, drive sprocket, clutch, and position sensors. The motor shall drive the door by means of a chain. Standard motor drive speeds range from 6”-10” per second.
 - a. High speed motor operation up to 18” per second is available for conditions requiring high occupant load egress and limited access control.
 - b. Leading Edge shall be pressure sensitive such that contact with an obstruction shall cause the door to stop, pause for a minimum of 3 seconds, then re-close when in alarm mode.
 - 3. Exit Device will be located on each side of the door. (Standard operation when access control is not included).
 - 4. An optional key switch by others may be provided for operating the door opened and closed when not in fire mode. Location of the key switch to be provided by the architect.
- E. The header shall be provided as an integrated part of the door assembly and shall Include track, threaded rods and mechanical attachment hardware.

2.05 OPTIONS

- A. Vision Panel consisting of a frame and clear glass assembly listed by Underwriters Laboratory

- B. Individual LCD Door Status Display Panel shall be provided adjacent to the door to indicate in the English language the status of the door, i.e., door position and trouble conditions. It shall have a port that allows easy access to a diagnostic tool for the purposes of field programming the door to customized settings.
- C. Backlit Exit Device. High intensity LED illuminated exit device increases visibility and provides a more effective identification of exit location.
- F. Remote monitoring. The doors shall be monitored by providing one pair of 18-gauge wires from the monitoring station to each Won-Door location for each condition to be monitored. Normally open dry contact relays for supervisory, trouble, door status, and alarm conditions are provided in the Won-Door controller. If additional outputs are required to monitor the doors, an additional auxiliary relay module (XRM) shall be provided with two additional relays to indicate specific status and fault conditions including any two of the following: Open, Opening, Closing, Stopped, Locked, Exit Device Access, Secure Access, Forced Entry, TLS Failure, Key Switch Failures, Stuck switches, Power Failures, Communication Errors.
- G. Reset Devices (required to clear the door from fault and alarm mode.) Options include:
 - 1. Key Switch by others (Requires a 2 position, spring activation to neutral, normally open switch).
 - 2. Key switch by Won-Door.
 - 3. Wireless Key Switch by Won-Door using energy harvesting technology (no batteries required) for same room installation consisting of a key cylinder and wireless transmitter in an [ON/OFF/ON] configuration and wireless access module.
 - 4. Wireless Reset Device by Won-Door using energy harvesting technology (no batteries required) for same room installation consisting of a wall mounted device that accepts any key card to activate a wireless transmitter that can be mounted directly to the wall. Requires Wireless Access Module to operate.
- H. Air Pressure Resistance. When an air pressure differential is present at the door location, the standard door shall be capable of resisting an air pressure differential of 0.05" of water column. For air pressure differentials of 0.05" to 0.1" w.c., anti-sway brackets shall be placed interior to the door approximately every five (5) feet or less and lead post outriggers shall be provided. For air pressure differentials of 0.1" to 0.15" w.c., a reinforced vertical bar shall be provided at the lead post and a self-leveling lead post assembly shall provide motorized tracking of the leading edge of the door to assure proper closure at the striker.
- I. Obstruction Test will enable all doors to be checked for obstructions every 24 hours. When enabled, the door will close across the opening to assure there has been no obstructions placed in the door path. If no obstruction is encountered, the door returns to the pocket location. If an obstruction does occur, the door will stop at the location of the obstruction and sound an alarm. Once the obstruction is removed, the alarm can be cleared and the door returned to the pocket location.

- J. Infrared Obstruction Detector is an infrared light beam provided to monitor the opening path. If an object is placed in the path of the door for more than 3 minutes, the beam shall cause the door to sound an alarm indicating a path obstruction.

2.06 RELATED CONSTRUCTION

- A. Track Support Construction: Provide supports attached to structure and mounting surface for track including drilling/placement of anchorage points into pre or post tensioned decks, welding/punching/drilling steel members, and all drywall work; comply with door manufacturer's instructions and recommendations.
- B. Pocket Construction: Provide rated pocket as specified for storage of accordion door when open; comply with door manufacturer's instructions and recommendations.
- C. Protection: Protect installed work from damage.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify that adjacent construction is suitable for installation of door.
- B. Verify that electrical utilities have been installed and are accessible.
- C. Verify clear opening dimensions and that door opening is plumb.
- D. Notify Architect of any unacceptable conditions or varying dimensions.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions, shop drawings and NFPA 80.
- B. Install fire doors plumb and parallel with the finished floor.
- C. Installation shall be performed by factory trained and certified installers with experience installing electrically operated accordion folding fire doors.

3.03 ADJUSTING

- A. Adjust door installation to provide uniform clearances and smooth, quiet, non-binding operation.
- B. Test that all operations are functional and meet the requirements of local codes.

3.04 CLEANING

- A. Clean surfaces using manufacturer's recommended means and methods.

3.05 STORAGE OF WASTE AND RECYCLING

- A. Store and recycle waste in accordance with Section 01 74 19 Construction Waste Management and Disposal.

END OF SECTION

SECTION 08 44 10

GLAZED WINDOW WALL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide factory finished aluminum framed window wall systems including glass, glazing materials, structural anchors, attachments, shims, and accessories as required for complete weather-tight installation.
 - 1. Window wall systems include storefront systems, curtain wall systems, fixed and operable windows, and aluminum and glass entry door systems, including glazing and hardware.
- B. Related Work:
 - 1. Section 07 90 00: Perimeter sealants and back-up materials.
 - 2. Section 08 42 30: Automatic entrances.
 - 3. Section 08 51 10: Aluminum windows.
 - 4. Section 08 71 00: Cylinders for door locks
 - 5. Section 08 71 15: Low energy automatic door operators.

1.2 REFERENCES

- A. American Architectural Manufacturers Association (AAMA): Metal Curtain Wall, Window, Store Front and Entrance Guide Specifications Manual.
- B. Glass Association of North America (GANA): Glazing Manual and Sealant Manual.
- C. National Association of Architectural Metal Manuf. (NAAMM): Metal Finishes Manual.
- D. Definitions: National Association of Architectural Metal Manufacturers (NAAMM), Glossary of Architectural Metal Terms.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Design/Build: Provide special engineering for glazed window wall assemblies to ensure they comply with applicable codes and Contract Documents.
- B. Coordination: Coordinate methods for making junctures with adjacent surfaces watertight with Section 07 90 00 – Joint Sealants.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications and product data for window wall system, glass, and major manufactured components.

- B. Shop Drawings: Indicate pertinent dimensioning, clearances, general construction, anchorage locations, and typical details.
 - 1. Include elevations at 1/4 scale, typical unit elevations at 1" scale and half or full-size detail sections of typical composite members.
 - 2. Indicate joint systems, expansion provisions and glazing details.
- C. Samples:
 - 1. Aluminum: Where color range can be anticipated, submit two sets of range samples indicating anticipated variance in finish.
 - 2. Glass: Submit each type specified except clear glass.
 - 3. Frame: Submit corner construction indicating profile, size and joining method of a mullion and sill at a glass panel.
- D. Test Reports: Submit laboratory reports of tests run on typical section of window wall system.
 - 1. Test for Air Infiltration: ASTM E283 at 6.24-psf pressure difference.
 - 2. Test for Water Penetration under Static Pressure: ASTM E331 using static air pressure difference of minimum 20% of inward acting design wind load pressure, but not less than 6.24-psf.
 - 3. Test for Water Penetration under Dynamic Pressure: AAMA 501.1.
 - 4. Test for Structural Performance: ASTM E330. Minimum test loads shall be those specified.
 - a. Minimum ultimate loads shall be loads specified multiplied by factors of safety specified in California Building Code.
 - b. Measure deflections at member center lines and other critical points as deemed appropriate.
 - c. Safety Factor: Design for specified pressures with no glass breakage, no permanent damage to fasteners, and no permanent deformation of framing exceeding 0.2% of member clear span.
 - 1) Glass safety factor relates to testing procedure, not occurrence of glass breakage in final installation.
- E. Design/Build Certificates: Submit certification signed by California licensed structural engineer indicating compliance with Contract Documents and code requirements.

1.5 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to energy efficiency.

- B. Installer Qualifications: Firm acceptable to system manufacturer and with not less than five years successful experience installing systems of comparable type and size.
- C. Mock-Up: Provide mock-up as indicated, as directed by Architect where not otherwise indicated; approved mock-up may be incorporated into Project.

1.6 WARRANTY

- A. Extended Correction Period: Provide for correcting failure of system to resist damage from anticipated sources including damage from wind and water penetration.
 - 1. Repair or replace units which fail in materials or workmanship.
 - a. Excessive air infiltration.
 - b. Excessive deflections.
 - c. Deterioration of finish and deterioration of metal.
 - d. Defects in weather-stripping.
 - e. Defects in glass.
 - 2. Period: Two years.
- B. Manufacturer's Warranty: Submit manufacturer's warranty including special manufacturer services as required for manufacturer's warranty.
 - 1. Period: 20 years.
 - 2. Manufacturer's warranty shall not detract from requirements of extended correction period nor from Owner's rights under implied and expressed warranties regardless of wording of manufacturer's warranty.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Arcadia, Inc.
- B. Kawneer, an Arconic Company.
- C. Oldcastle BuildingEnvelope.
- D. EFCO Corporation.
- E. TRACO.
- F. C.R. Laurence, United States Aluminum Div.
- G. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide factory finished aluminum framed window wall systems including glass, glazing materials, structural anchors, attachments, shims, and accessories, and including storefronts, curtain walls, windows, and entry doors.

- B. Regulatory Requirements: Comply with requirements of applicable codes.
 - 1. Safety Glass: Comply with applicable building code, CPSC 16 CFR 1201, and pass ANSI Z97.1.
 - 2. Accessibility: Provide for assuring access for persons with disabilities in accordance with state and federal regulations.
 - a. California Regulations: Comply with California Building Standards Code.
 - b. Federal Regulations: Comply with Americans with Disabilities Act (ADA) Standards.
 - 3. Energy: Comply with California Energy Commission requirements regarding energy performance of window wall assemblies.
 - a. Manufacturer shall be responsible for providing information required by authorities necessary to verify conformance.
 - b. Entire assembly, including glass and glazing, shall be certified by National Fenestration Rating Council (NFRC) and shall bear NFRC Label indicating energy performance technical information.
- C. Design Criteria: Provide complete system with joints, gaps, and penetrations made watertight.
- D. Performance Criteria:
 - 1. Deflections and Thermal Movements: Size primary members for deflection limitations and temperature variations as follows; fabricate, assemble and erect work to maintain limitations.
 - a. Normal-to-wall deflection of $L/175$ of span; except $L/250$ of span for glass supporting members.
 - b. Parallel-to-wall deflection of less than 75% of glass edge clearances.
 - c. Thermal expansion and contraction movements resulting from not less than ambient temperature range of 100 degrees F, which may cause a material temperature range of 160 degrees F.
 - 2. Water and Air Leakage: Installed system shall be free of significant leakage of both water and air.
 - a. Water leakage is defined as uncontrolled penetration of water (not including condensation) to interior of building.
 - b. Air leakage is defined as infiltration of air at any area of window wall, at a rate exceeding 0.06 cfm/sf of area, based on measurement of single complete module of system.

3. Condensation: Design system to prevent excessive condensation on indoor faces, with heating and ventilating system in operation, and under following conditions.
 - a. Outdoor: Ambient temperature 20-degrees F; 15-mph wind.
 - b. Indoor: Ambient temperature 75-degrees F; relative humidity of 25%.
 - c. Excessive Condensation: Visible water on more than 10% of interior exposed surface of any section, or accumulation or uncontrolled flow of water from condensation at any location.
- E. Glazed Aluminum Framed Window Wall Systems: Systems with profiles as indicated on Drawings; provide extruded aluminum security type glass stops of profile to suit frame design.
 1. Finish, Clear Anodized: Clear anodized coating conforming with NAAMM Metal Finishes Manual, Architectural Class I, 0.7 mil or greater.
- F. Doors, Frames, and Hardware: Barrier-free entry doors meeting code requirements for providing access for people with physical disabilities; by entrance manufacturer.
 1. Type: Medium stile with 3-1/2" stiles and top rail, and 10" bottom rail.
 1. Metal and Finish: Match entrance system.
 2. Hardware: Provide complete hardware system except as indicated; match window wall system finish unless otherwise directed by Architect. Coordinate with Section 08 71 00 – Door Hardware.
 - a. Pivots/Closers: Center-hung pivots with concealed adjustable type closer, maximum 5-pound operating pressure when installed in final application.
 - b. Hinges: Extra heavy-duty ball bearing full mortise (butt) hinges complying with requirements specified in Section 08 71 00.
 - c. Closers: Concealed adjustable type closer, maximum 5-pound operating pressure when installed in final application.
 - d. Push/Pulls: Types as indicated on Drawings; where not otherwise indicated manufacturer's standard types as selected by Architect; match finish of similar hardware as specified in Section 08 71 00.
 - e. Security Locks: Manufacturer's standard.
 - 1) Cylinders: Provided under Section 08 71 00.
 - f. Weather-Stripping, Sweep Strips: Manufacturer's recommended standard type, to suit application.
 - g. Thresholds: Maximum 1/2" height above adjacent surfaces, with maximum 1/4" vertical section and remainder maximum 1:2 slope.

- G. Glass: Provide minimum thicknesses specified, but no less than thicknesses required based on window size and configuration and anticipated wind loading.
1. Manufacturers:
 - a. Vitro Architectural Glass (PPG).
 - b. Guardian Industries Corp.
 - c. Oldcastle Glass.
 - d. Viracon.
 - e. Substitutions: Refer to Section 01 25 00.
 2. Float Glass: Select glazing quality, clear float glass, ASTM C1036; nominal thickness 1/4".
 3. Tempered Glass: Select glazing quality, clear float glass, fully tempered, ASTM C1048; nominal thickness 1/4"; safety glass.
 4. Tinted Glass: Manufacturer's standard tint as directed by Architect.
 - a. Use one thickness of tinted glass throughout unless otherwise indicated or approved in advance by Architect.
 5. Laminated Glass: ASTM C1172, Kind LA, two sheets of clear float glass laminated with polyvinyl butyral film; safety glass; laminated layers free of air pockets and foreign substances.
 - a. Glass Thickness: 1/4", unless otherwise indicated.
 - b. Polyvinyl Butyral Core Thickness: Not less than 30 mil.
 6. Insulated Glass: Preassembled units consisting of organically sealed panes of glass enclosing a hermetically sealed dehydrated air space with minus 20-degree F dew point.
 - a. Performance: Certified to ASTM E2190 by Insulating Glass Certification Council.
 - b. System: Manufacturer's standard dual seal system compatible with glazing system, and including spacers, desiccant, and standard corner construction.
 - c. Glass:
 - 1) Float Glass (Typical): Select glazing quality, clear float glass, ASTM C1036; nominal thickness 1/4".
 - 2) Tempered Glass (Where Indicated and Where Safety Glazing is Required): Select glazing quality, clear float glass, fully tempered, ASTM C1048; nominal thickness 1/4"; safety glass.
 - 3) Low Emissivity Coating: Provide high performance Low E coating on Number 2 surface, comparable to Vitro (PPG)/SolarBan 60.
 - 4) Tinted Glass: Manufacturer's standard tint as directed by Architect.

- a) Use one thickness of tinted glass throughout unless otherwise indicated or approved in advance by Architect.
- 5) Spandrel Glass: Double density ceramic frit, heat strengthened spandrel glass; nominal 1/4" thickness.
- d. Total Unit Thickness: nominal 1".
- H. Glazing Materials: Of type recommended by system manufacturer to suit security locations and applications for glazing installation; designed to maintain glass in place and prevent movement.
 - 1. Setting Blocks: Neoprene or EPDM, 80-90 Shore A durometer hardness; 4" long by 3/8" thick by 1/4" high; ASTM C864.
 - 2. Spacer Shims: Neoprene or EPDM; 45-55 Shore A durometer hardness; 3" long by 3/32" thick by 1/4" high; ASTM C864.
 - 3. Edge Blocks: Neoprene or EPDM, 60-70 Shore A durometer hardness; 4" long with minimum two per jamb located at top and bottom edges of glass; ASTM C864.
 - 4. Glazing Gaskets: Exterior neoprene or EDPM; interior neoprene, EPDM or vinyl; miter corner joints at exterior applications; conform to ASTM C509 or C864.
 - 5. Glazing Sealants: ASTM C920, Type S, Grade NS, elastomeric one-component silicone glazing sealants as recommended by sealant manufacture for application involved.
 - a. Manufacturers:
 - 1) Dow Corning Corp.
 - 2) General Electric Co.
 - 3) Pecora Corp.
 - 4) Tremco Inc.
 - 5) Substitutions: Refer to Section 01 25 00.
 - b. Structural Glazing: Provide high-modulus structural silicone glazing materials recommended by sealant manufacturer for applications where sealant bonds glass to metal system.
 - c. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- I. Miscellaneous Materials:
 - 1. Fasteners: Aluminum or non-magnetic stainless steel of type which will not cause electrolytic action or corrosion.
 - a. Do not use exposed fasteners except where unavoidable for assembly or for application of hardware.

- b. Indicate exposed fasteners on shop drawings for specific approval; exposed fasteners shall be Phillips flat-head screws or Allen screws with finish matching item fastened.
 - c. Provide concealed fasteners for glazing stops.
- 2. Steel Reinforcement and Brackets: Manufacturer's standard with minimum 2 oz. hot-dip zinc coating, ASTM A123, applied after fabrication.
- 3. Bituminous Paint: Cold-applied mastic, SSPC Paint 12, compounded for 30 mil thickness per coat.
- 4. Flashing: Provide sub-sill flashing members for fixed exterior framing; minimum 22-gage sheet aluminum of sizes and shapes indicated and required to drain water to exterior.
 - a. Finish: Match adjacent aluminum primary members.
- 5. Anchoring Devices: Corrosion resistant type capable of supporting window wall system and superimposed design loads; design to allow adjustments of system prior to being permanently fastened in place.

2.3 FABRICATION

- A. Fabricate systems to allow for adequate clearances around perimeter and to enable proper installation; allow for thermal movement within window wall construction.
- B. Fabricate components allowing for accurate and rigid fit of joints and corners; match components carefully ensuring continuity of line and color, with joints and connections flush, hairline and weatherproof.
- C. Provide structural reinforcing within framing members where required to maintain rigidity and as required to accommodate design loads.
- D. Allow moisture entering joints and condensation occurring within framing members to drain to exterior.
 - 1. Design drainage system to hold maximum anticipated moisture for 100-year rain cycle without overflowing.
- E. Complete cutting, fitting, forming, drilling and grinding of metal work prior to cleaning, finishing, treatment, and application of coating.
- F. Finishing: After fabrication, prepare surfaces for finishing in accordance with recommendations of aluminum producer and finish manufacturer.
 - 1. Finish components of each assembly simultaneously to attain uniformity of color.
 - 2. Sequence finishing and processing of materials in a predetermined bay-by-bay, floor-by-floor, wall-by-wall plan.

- G. Weld by methods recommended by metal manufacturer and AWS; grind exposed welds smooth and restore mechanical finish; remove arises from cut edges and corners to a radius of approximately 1/64".
- H. Fit and assemble work at shop to greatest extent possible; disassemble only as required for shipment and erection.
- I. Reinforce work as necessary for performance requirements and for support.
 - 1. Provide internal reinforcing for hardware.
- J. Separate dissimilar materials with bituminous paint or preformed separators which will prevent corrosion.
- K. Separate metal surfaces at moving joints with plastic inserts or other non-abrasive concealed inserts which permanently prevent "freeze-up" of joint.
- L. Fabricate doors and apply hardware in shop. Disassemble only as required for transportation and installation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install glazed aluminum window wall assemblies in accordance with manufacturer's recommendations and installation instructions, and to meet design criteria and performance criteria indicated, for weather-tight installation.
 - 1. Separate aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- B. Ensure assembly is plumb, level and free of warp or twist; maintain dimensional tolerances and alignment with adjacent work.
- C. Tolerances: Accurately align and locate components to column lines and floor levels; adjust work to conform to following tolerances.
 - 1. Plumb: 1/8" in 10'-0"; 1/4" in 40'-0"; non-cumulative.
 - 2. Level: 1/8" in 20'-0"; 1/4" in 40'-0"; non-cumulative.
 - 3. Alignment: Limit offset to 1/16" where surfaces are flush or less than 1/2" out of flush and separated by less than 2" (by reveal or protruding work); otherwise limit offsets to 1/8".
 - 4. Location: 3/8" maximum deviation from measured theoretical location (any member, and location).
- D. Install anchorage devices to securely and rigidly fasten system to building.
- E. Provide anchors to be installed in other work, and setting details, in time for proper installation by trades concerned; verify correct placement.

- F. Set sill members and similar members in bed of compound, joint fillers or gaskets to provide weather-tight construction.
- G. Install hardware in accordance with manufacturer's recommendations, using proper templates.
 - 1. Install doors to operate freely and smoothly, with a maximum operating pressure of 5-pounds in accordance with California Building Code, Chapter 11B, Division III, Section 1133B2.5.
 - 2. Coordinate installation of cylinders with Section 08 71 00 - Hardware.
 - 3. Install sill members and thresholds in bed of compound, joint fillers or gaskets to provide weather-tight construction.
- H. Install glass in accordance with glass manufacturer's instructions and with GANA "Glazing Manual".
 - 1. Do not allow glass to touch metal surfaces.

3.2 CLEANING

- A. Clean aluminum surfaces promptly after installation of components, exercising care to avoid damage of finish.
- B. Remove excess sealant compounds, dirt and other foreign substances.
- C. Mark glass after installation by crossed streamers attached to framing and held away from glass; do not apply markers to surface of glass.
- D. Remove nonpermanent labels immediately after sealant cures; cure sealants for high early strength and durability.

3.3 PROTECTION

- A. Remove and replace glass which is broken, chipped, cracked, abraded or damaged during construction period, including natural causes, accidents and vandalism.

3.4 FIELD QUALITY CONTROL

- A. Site Tests: Conduct tests for air and water infiltration with window wall manufacturer's representative present; correct units failing tests; independent laboratory subject to Architect approval.
 - 1. Air Infiltration: Conduct in accordance with ASTM E783 with static difference of specified and with maximum infiltration of 1.5 times amount specified.
 - 2. Water Penetration: Conduct in accordance with ASTM E1105 at static pressure as recommended by NAAMM with no uncontrolled water penetration.
 - 3. Water Spray Test: Conduct in accordance with AAMA 501.2 on lower two floors of building with minimum 75 lineal feet of units.

END OF SECTION

SECTION 08 51 10

ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide aluminum windows with integral flashing, glazing, and accessories as required for complete weather-tight installation.
- B. Related Work:
 - 1. Section 07 90 00: Perimeter joint sealers and back-up material.

1.2 REFERENCES

- A. American Architectural Manufacturers Association (AAMA) and Window and Door Manufacturers Association (WDMA), AAMA/WDMA 101/I.S. 2, Voluntary Specifications for Aluminum, Vinyl (PVC), and Wood Window and Glass Doors.
- B. Glass Association of North America (GANA): Glazing Manual.
- C. National Association of Architectural Metal Manuf. (NAAMM): Metal Finishes Manual.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturers' literature including test results indicating compliance with design criteria.
- B. Shop Drawings: Indicate pertinent dimensioning, general construction, component connections and locations, anchor methods and locations.
- C. Samples: Furnish samples of metal finish and glass.
- D. Test Reports: Include laboratory test results for STC and OITC rating of units.

1.4 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to energy efficiency.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack units on edge on wood strips above ground.

1.6 WARRANTY

- A. Extended Correction Period: Extend correction period to two years.
 - 1. Provide for correcting failure of Sound Transmission Coefficient rating (STC).

2. Provide for correcting failure of insulating glass. Failure includes signs of moisture on interior surfaces of insulated glass units and bond failure of laminated glass.
 3. Repair or replace systems and materials which fail to perform as intended.
- B. Manufacturer's Warranty: Submit manufacturer's warranty including special manufacturer services as required for manufacturer's warranty.
1. Period: 20 years.
 2. Manufacturer's warranty shall not detract from requirements of extended correction period nor from Owner's rights under implied and expressed warranties regardless of wording of manufacturer's warranty.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Kawneer, an Arconic Company.
- B. EFCO Corporation.
- C. U.S. Aluminum Division, C.R. Laurence Company, Inc.
- D. Arcadia, Inc.
- E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide quality aluminum windows with glazing, hardware, and accessories as indicated.
 1. Manufacturer: Provide each type of window by single manufacturer. Provide all windows by single manufacturer where all types are available from approved manufacturer.
 2. Standards: Conform to AAMA/WDMA 101/I.S.2, types as indicated.
- A. Regulatory Requirements: Comply with California Building Code.
 1. Safety Glass Standards: Comply with California Building Code and CPSC 16 CFR 1201, and pass ANSI Z97.1.
 2. Energy Requirements: Comply with California Energy Commission requirements regarding energy performance of windows.
 - a. Manufacturer shall be responsible for providing information required by authorities necessary to verify conformance.

- b. Entire assembly, including glass and glazing, shall be certified by National Fenestration Rating Council (NFRC) and shall bear NFRC Label indicating energy performance technical information.
- B. Performance Requirements: Comply with applicable codes and AAMA 101 for each type of window specified, but no less than as required for Performance Class listed.
 - 1. Structural: Withstand code required wind loads on exterior and on interior when tested in accordance with ASTM E330, without breakage, failure, or malfunction of operation.
 - 2. Forced Entry: Provide systems conforming to ASTM F588 for windows, Performance Level 10 or AAMA 1302.5 where at ground floor and at areas accessible from decks and accessible rooftops.
 - 3. Acoustical Ratings: Provide windows that have been tested under ASTM E90 with minimum Sound Transmission Class (STC) rating and Outdoor Indoor Transmission Class (OITC) ratings as indicated on Drawings.
 - 4. Label: "AAMA Quality Certified" label is required on each window.
- C. Aluminum Windows: Provide units meeting requirements of Architectural Aluminum Manufacturers Association (AAMA) Certification Program.
 - 1. Performance Class: Not less than AAMA -CW (Commercial).
 - a. Provide windows and doors meeting AAMA/WDMA 101/I.S.2 performance class as required to comply with California Building Code wind loads as listed in Chapter 16.
- D. Aluminum: Of sizes, shapes and profiles shown; alloys and tempers as recommended by manufacturer and processor to comply with requirements for performance, fabrication, and finish application.
 - 1. Thermal Breaks: Provide units with thermal breaks in metal to prevent transfer of temperature between interior and exterior surfaces; conform to AAMA 1502 with factor of 45.
 - 2. Divided Lites: True divided lites required.
 - 3. Clear Anodized Finish: Clear anodized finish not less than Architectural Class 1 (0.7 mil thick), NAAMM AA-C22A41.
 - 4. Protect finishes with manufacturer recommended methods.
- E. Glass:
 - 1. Typical: ASTM C1036, select glazing quality clear float glass; thickness nominal 1/4".
 - 2. Insulated Glass: Preassembled units consisting of organically sealed panes of glass enclosing a hermetically sealed dehydrated air space with -20 degree F dew point.

- a. Performance: Certified to ASTM E2190 by Insulating Glass Certification Council.
 - b. System: Manufacturer's standard dual seal system compatible with glazing system, and including spacers, desiccant, and standard corner construction.
 - c. Glass: ASTM C1036, select glazing quality clear float glass; nominal thickness 1/4".
 - 1) Safety Glass: ASTM C1048, Kind FT, fully tempered select glazing quality glass; provide where required by applicable codes and regulations; pass ANSI Z97.1.
 - d. Low E Coating: High performance low emissivity coating comparable to Vitro (PPG)/SolarBan 60 on No. 2 surface.
 - e. Total Unit Thickness: nominal 1".
- F. Glazing Materials: Manufacturer standard type to suit locations and applications.
- G. Miscellaneous Materials:
- 1. Fasteners: Anodized aluminum or non-magnetic stainless steel of type not causing electrolytic action or corrosion; provide flush Phillips flat-head or Allen screws where exposed.
 - 2. Finish exposed aluminum fasteners to match aluminum work.
 - 3. Brackets and Reinforcements: Aluminum wherever possible, where steel units are required for higher strength or other unavoidable necessity, hot-dip galvanize after fabrication; ASTM A123 G-90.
 - 4. Bituminous Paint: Cold applied asphalt mastic complying with SSPC-Paint 12, compounded for 30-mil thickness per coat.
- H. Weather-Stripping:
- 1. Fixed Panels: Neoprene gaskets complying with ASTM D2000, Designations 2BC415 to 3BC620.

2.3 FABRICATION

- A. Fabricate units to allow for clearances and shim spacing around perimeter to enable installation; provide for thermal movement and slope and weep sills for drainage.
- B. Provide anchorage devices to securely and rigidly fit windows in place.
- C. Accurately fit together joints and corners; match components ensuring continuity of line and design; ensure joints and connections are flush, hairline and weatherproof.
- D. Apply coat of bituminous paint on concealed aluminum surfaces to be in contact with cementitious or dissimilar materials.

- E. Glass Installation: Conform to requirements in GANA "Glazing Manual"; glass shall not touch metal.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine surfaces of openings and verify dimensions.
- B. Installation of units constitutes acceptance of existing conditions.

3.2 INSTALLATION

- A. Assemble and anchor various components to allow for expansion and contraction, maintaining weather-tight condition.
- B. Install units in strict compliance with manufacturer's recommendations and installation instructions.
- C. Install work plumb, straight, square, level and in their proper elevation, plane and location, and in proper alignment with other work.
- D. Anchor securely in place, separate aluminum and other corrodible metal surfaces from corrosion and electrolytic action with other materials.
- E. Upon completion of installation, remove protective coatings or coverings and clean aluminum surfaces.

3.3 FIELD QUALITY CONTROL

- A. Site Tests: Conduct tests for air and water infiltration with window manufacturer's representative present; correct units failing tests.
 - 1. Test: Conduct in accordance with AAMA 502.
 - 2. Air Infiltration: Maximum infiltration of 1.5 times amount specified.
 - 3. Water Penetration: Conduct at pressures recommended by AAMA for specified units.

3.4 CLEANING

- A. Clean windows including glazing using methods recommended by window manufacturer; minimum wash down with solution of mild detergent in warm water applied with soft, clean cloths.
 - 1. Take care to remove dirt from corners.
 - 2. Wipe surfaces clean.

3.5 PROTECTION

- A. Protect units and glazing from damage from construction operations and from vandalism.

- B. Repair or replace damaged metal components. Touch-up damaged finishes.
- C. Remove and replace glass that is broken, chipped, cracked, abraded or damaged during construction period, including natural causes, accidents and vandalism.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware for:

- a. Swinging doors.
- b. Gates.
- c. Roll-up Doors.

B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

- 1. Windows
- 2. Cabinets (casework), including locks in cabinets.
- 3. Signage
- 4. Toilet accessories
- 5. Overhead doors
- 6. Installation.
- 7. Rough hardware.
- 8. Conduit, junction boxes & wiring.
- 9. Folding partitions, except cylinders where detailed.
- 10. Sliding aluminum doors, except cylinders where detailed.
- 11. Access doors and panels, except cylinders where detailed.

C. Related Sections:

- 1. Division 01 Section "Alternates" for alternates affecting this section.
- 2. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
- 3. Division 09 sections for touchup finishing or refinishing of existing openings modified by this section.
- 4. Division 26 sections for connections to electrical power system and for low-voltage wiring.
- 5. Division 28 sections for coordination with other components of electronic access control system.

1.3 REFERENCES

- A. UL - Underwriters Laboratories

1. UL 10B - Fire Test of Door Assemblies
 2. UL 10C - Positive Pressure Test of Fire Door Assemblies
 3. UL 1784 - Air Leakage Tests of Door Assemblies
 4. UL 305 - Panic Hardware
- B. ANSI - American National Standards Institute
1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
- C. California Code of Regulations
1. Title 24: California Building Standards Code

1.4 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 requirements.

B. Action Submittals:

1. Product Data: Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
 - a. Wiring Diagrams: For power, signal, and control wiring and including:
 - 1) Details of interface of electrified door hardware and building safety and security systems.
 - 2) Schematic diagram of systems that interface with electrified door hardware.
 - 3) Point-to-point wiring.
 - 4) Risers.
3. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier in like-new condition. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
4. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
 - a. Door Index; include door number, heading number, and Architects hardware set number.
 - b. Opening Lock Function Spreadsheet: List locking device and function for each opening.

- c. Type, style, function, size, and finish of each hardware item.
- d. Name and manufacturer of each item.
- e. Fastenings and other pertinent information.
- f. Location of each hardware set cross-referenced to indications on Drawings.
- g. Explanation of all abbreviations, symbols, and codes contained in schedule.
- h. Mounting locations for hardware.
- i. Door and frame sizes and materials.
- j. Name and phone number for local manufacturer's representative for each product.
- k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components). Operational description should include how door will operate on egress, ingress, and fire and smoke alarm connection.
 - 1) Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.

5. Key Schedule:

- a. Initiate and conduct meeting(s) with Owner representatives and hardware supplier to determine system keyway(s), keybow styles, structure, stamping, degree of physical security and degree of geographic exclusivity. Furnish Owner's written approval of the system; do not order keys or cylinders without written confirmation of actual requirements from the Owner.
- b. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used, and door numbers controlled.
- c. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
- d. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
- e. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
- f. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
 - 1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.

6. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.

C. Informational Submittals:

- 1. Qualification Data: For Supplier and Installer.
- 2. Product Certificates for electrified door hardware, signed by manufacturer:

- a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
- 3. Certificates of Compliance:
 - a. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in "QUALITY ASSURANCE" article, herein.
- 4. Warranty: Special warranty specified in this Section.
- D. Closeout Submittals:
 - 1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Name, address, and phone number of local representative for each manufacturer.
 - d. Final approved hardware schedule, edited to reflect conditions as installed.
 - e. Final keying schedule
 - f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
 - g. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.5 QUALITY ASSURANCE

- A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.
 - 1. Where specific manufacturer's product is named and accompanied by "Owner Standard," including make or model number or other designation, provide product specified. (Note: Certain products have been selected for their unique characteristics and particular project suitability.)
 - a. Where no additional products or manufacturers are listed in product category, requirements for "Owner Standard" govern product selection.
 - 2. Where products indicate "acceptable manufacturers" or "acceptable manufacturers and products", provide product from specified manufacturers, subject to compliance with specified requirements and "Single Source Responsibility" requirements stated herein.
- B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project.
 - 1. Scheduling Responsibility: Preparation of door hardware and keying schedules.
 - 2. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of

- manufacturer's standard units in assemblies similar to those indicated for this Project.
3. Coordination Responsibility: Coordinate installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.
 - a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.
 - C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.
 - D. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
 1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.
 2. Manufacturers that perform electrical modifications and that are listed by testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
 - E. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
 - F. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
 - G. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
 - H. Means of Egress Doors: Latches do not require more than 5 lbs (67 N) to release latch. Locks do not require use of key, tool, or special knowledge for operation.
 - I. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article, herein.
 1. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist and that operate with force of not more than 5 lbs (22.2 N).
 2. Maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbs (22.2 N) applied perpendicular to door.
 - b. Sliding or Folding Doors: 5 lbs (22.2 N) applied parallel to door at latch.

- c. Fire Doors: The minimum opening force allowable by the appropriate administrative authority, not to exceed 15 lbs (66.7N).
- 3. Bevel raised thresholds with slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
- 4. Adjust closer so that the time required to move the door from the 90-degree position to 12 degrees from the latch is 5 seconds minimum.
- J. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Inspect and discuss preparatory work performed by other trades.
 - 3. Inspect and discuss electrical roughing-in for electrified door hardware.
 - 4. Review sequence of operation for each type of electrified door hardware.
 - 5. Review required testing, inspecting, and certifying procedures.
- K. Coordination Conferences:
 - 1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.
 - a. Attendees: Door hardware supplier, door hardware installer, Contractor.
 - b. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.
 - 2. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.
 - a. Attendees: electrified door hardware supplier, doors and frames supplier, electrified door hardware installer, electrical subcontractor, Owner, Owner's security consultant, Architect and Contractor.
 - b. After meeting, provide letter of compliance to Architect, indicating when coordination conference was held and who was in attendance.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
 - 1. Deliver each article of hardware in manufacturer's original packaging.
- C. Project Conditions:
 - 1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.

2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- D. Protection and Damage:
1. Promptly replace products damaged during shipping.
 2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
 3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- E. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.7 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings:
1. Prior to submittal, carefully inspect existing conditions to verify finish hardware required to complete Work, including sizes, quantities, existing hardware scheduled for re-use, and sill condition material. If conflict between the specified/scheduled hardware and existing conditions, submit request for direction from Architect. Include date of jobsite visit in the submittal.
 2. Submittals prepared without thorough jobsite visit by qualified hardware expert will be rejected as non-compliant.
- F. Direct shipments not permitted, unless approved by Contractor.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Years from date of Substantial Completion, for durations indicated.
 - a. Closers:

- 1) Mechanical: 30 years.
- b. Exit Devices:
 - 1) Mechanical: 3 years.
 - 2) Electrified: 1 year.
- c. Locksets:
 - 1) Mechanical: 3 years.
 - 2) Electrified: 1 year.
- d. Key Blanks: Lifetime
2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.9 MAINTENANCE

A. Maintenance Tools:

1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Where "Owner Standard" is noted, submittals and substitution requests for other products will not be considered.
- B. Approval of manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturer" in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.
- C. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- D. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
- E. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.2 MATERIALS

A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.

2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
 3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
 4. Install hardware with fasteners provided by hardware manufacturer.
- B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.
- C. Cable and Connectors: Hardwired Electronic Access Control Lockset and Exit Device Trim:
1. Data: 24AWG, 4 conductors shielded, Belden 9843, 9841 or comparable.
 2. DC Power: 18 AWG, 2 conductor, Belden 8760 or comparable.
 3. Provide type of data and DC power cabling required by access control device manufacturer for this installation.
 4. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with sufficient number and wire gauge with standardized Molex plug connectors to accommodate electric function of specified hardware. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.3 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Ives 5BB series
 - a. Acceptable Manufacturers and Products: Hager BB series, Stanley FBB Series.

B. Requirements:

1. Provide five-knuckle ball bearing hinges conforming to ANSI/BHMA A156.1.
2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
 - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
 - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
3. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
 - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high

- b. Interior: Heavy weight, steel, 5 inches (127 mm) high
- 4. 2 inches or thicker doors:
 - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
- 5. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
- 6. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
- 7. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins
- 8. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
- 9. Doors 36 inches (914 mm) wide or less furnish hinges 4-1/2 inches (114 mm) high; doors greater than 36 inches (914 mm) wide furnish hinges 5 inches (127 mm) high, heavy weight or standard weight as specified.
- 10. Provide hinges with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component.
- 11. Provide mortar guard for each electrified hinge specified.
- 12. Provide spring hinges where specified. Provide two spring hinges and one bearing hinge per door leaf for doors 90 inches (2286 mm) or less in height. Provide one additional bearing hinge for each 30 inches (762 mm) of additional door height.

2.4 CONTINUOUS HINGES

A. Aluminum Geared

- 1. Manufacturers:
 - a. Scheduled Manufacturer: Ives.
 - b. Acceptable Manufacturers: Markar, Stanley.
- 2. Requirements:
 - a. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
 - b. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum, with 0.25-inch (6 mm) diameter Teflon coated stainless steel hinge pin.

- c. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
- d. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
- e. On fire-rated doors, provide aluminum geared continuous hinges that are classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
- f. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware.
- g. Install hinges with fasteners supplied by manufacturer.
- h. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.5 ELECTRIC POWER TRANSFER

A. Manufacturers:

- a. Scheduled Manufacturer: Von Duprin EPT-10
- b. Acceptable Manufacturers: ABH PT1000, Securitron CEPT-10

B. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires sufficient to accommodate electric function of specified hardware.

C. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.6 MORTISE LOCKS

A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product: Schlage L9000 series
- 2. Acceptable Manufacturers and Products: Best 45H series, Sargent 8200 series

B. Requirements:

- 1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1 Operational, Grade 1 Security, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
- 2. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
- 3. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
- 4. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide a request to exit (RX) switch that is actuated with rotation of inside lever.
 - a. UL Listed – 3-hour fire door.

5. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
 - a. Lever Design: As scheduled.

2.7 EXIT DEVICES :

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Von Duprin 98 series
2. Acceptable Manufacturers and Products: Sargent 8000 series, Precision Apex series.

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit or Fire Exit Hardware. Cylinders: Refer to "KEYING" article, herein.
2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
3. Touchpad: Extend minimum of one half of door width. Match exit device finish, stainless steel for US26, US26D, US28, US32, and US32D finishes; and for all other finishes, provide compatible finish to exit device. No plastic inserts are allowed in touchpads.
4. Provide exit devices with dead-latching feature for security and for future addition of alarm kits and/or other electrified requirements.
5. Provide flush end caps for exit devices.
6. Provide exit devices with manufacturer's approved strikes.
7. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
8. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
9. Provide cylinder dogging at non-fire-rated exit devices.
10. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
11. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.

- a. Lever Style: Match lever style of locksets.

12. Accessibility: Maximum 5lbs force to retract latch bolt per CBC Chapter 11B.

"AX" feature: touchpad directly retracts the latchbolt with 5 lbs. or less of force.
Provide testing lab certification confirming that the mechanical device is independent third-party tested to meet this 5 lb requirement.

13. Provide UL labeled fire exit hardware for fire rated openings.

14. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
15. Provide electrified options as scheduled.

2.8 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer: Schlage/ to match existing.
2. Acceptable Manufacturers: to match existing, per owner request.

B. Requirements:

1. Provide small format interchangeable core-SFIC cylinders/ cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Temporary Construction Cylinder Keying.
3. Nickel silver bottom pins.
4. Temporary Construction Cylinder Keying.
 - a. Provide construction cores that permit voiding construction keys without cylinder removal, furnished in accordance with the following requirements.
 - 1) Split Key or Lost Ball Construction Keying System.
 - 2) 3 construction control keys, and extractor tools or keys as required to void construction keying.
 - 3) 12 construction change (day) keys.
 - b. Owner or Owner's Representative will void operation of temporary construction keys.
5. Replaceable Construction Cores:
 - a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
 - 1) 3 construction control keys
 - 2) 12 construction change (day) keys.
 - b. Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2.9 KEYING

- A. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
- B. Provide cylinders/cores keyed into Owner's existing factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
- C. Requirements:
 1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.

- a. Master Keying system as directed by the Owner.
2. Forward biting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
3. Provide keys with the following features:
 - a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
 - b. Patent Protection: Keys and blanks protected by one or more utility patent(s)
4. Identification:
 - a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Blind code marks shall not include actual key cuts.
 - b. Identification stamping provisions must be approved by the Architect and Owner.
 - c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
 - d. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.
 - e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
5. Quantity: Furnish in the following quantities.
 - a. Change (Day) Keys: 3 per cylinder/core.
 - b. SFIC: Permanent Control Keys: 3.
 - c. Master Keys: 6.

2.10 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 4040XP series.
2. Acceptable Manufacturers and Products: Sargent 281 series.

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certifies closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter piston with 5/8-inch (16 mm) diameter double heat-treated pinion journal. QR code with a direct link to maintenance instructions.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.

5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards. Provide snap-on cover clip, with plastic covers, that secures cover to spring tube.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck. Provide graphically labelled instructions on the closer body adjacent to each adjustment valve. Provide positive stop on reg valve that prevents reg screw from being backed out.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117 or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.11 ELECTRO-MECHANICAL AUTOMATIC OPERATORS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN Senior Swing
2. Acceptable Manufacturers and Products: Besam SW200i, Horton 4000LE series

B. Requirements:

1. Provide low energy automatic operator units that are electro-mechanical design complying with ANSI/BHMA A156.19.
 - a. Opening: Powered by DC motor working through reduction gears.
 - b. Closing: Spring force.
 - c. Manual, hydraulic, or chain drive closers: Not permitted.
 - d. Operation: Motor is off when door is in closing mode. Door can be manually operated with power on or off without damage to operator. Provide variable adjustments, including opening and closing speed adjustment.
 - e. Cover: Aluminum.
2. Provide units with manual off/auto/hold-open switch, push and go function to activate power operator, vestibule interface delay, electric lock delay, hold-open delay adjustable from 2 to 30 seconds, and logic terminal to interface with accessories, mats, and sensors.
3. Provide drop plates, brackets, or adapters for arms as required to suit details.
4. Provide hard-wired motion sensors and/or actuator switches for operation as specified. Provide weather-resistant actuators at exterior applications.
5. Provide key switches, with LED's, recommended and approved by manufacturer of automatic operator as required for function as described in operation description of hardware sets. Cylinders: Refer to "KEYING" article, herein.
6. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at

pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.

7. Provide units with inputs for smoke evacuation doors, where specified, which allow doors to power open upon fire alarm activation and hold open indefinitely or until fire alarm is reset, presence detector input, which prevents closed door from opening or door that is fully opened from closing, hold open toggle input, which allows remote activation for indefinite hold open and close second time input is activated, vestibule inputs, which allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

2.12 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Trimco, Hager.

B. Requirements:

1. Provide push plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick and beveled 4 edges. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
2. Provide push bars of solid bar stock, diameter, and length as scheduled. Provide push bars of sufficient length to span from center to center of each stile. Where required, mount back-to-back with pull.
3. Provide offset pulls of solid bar stock, diameter, and length as scheduled. Where required, mount back-to-back with push bar.
4. Provide flush pulls as scheduled. Where required, provide back-to-back mounted model.
5. Provide pulls of solid bar stock, diameter, and length as scheduled. Where required, mount back-to-back with push bar.
6. Provide pull plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
7. Provide wire pulls of solid bar stock, diameter, and length as scheduled.
8. Provide decorative pulls as scheduled. Where required, mount back-to-back with pull.

2.13 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Hager, Trimco, NGP.

B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:

- a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs.
- b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs.
- c. Armor Plates: 36 inches (914 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

2.14 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

- 1. Scheduled Manufacturers: Glynn-Johnson
- 2. Acceptable Manufacturers: Rixson, Sargent

B. Requirements:

- 1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.
- 2. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.
- 3. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.
- 4. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

2.15 DOOR STOPS AND HOLDERS

A. Manufacturers:

- 1. Scheduled Manufacturer: Ives
- 2. Acceptable Manufacturers: Rockwood, Trimco, Hager

B. Provide door stops at each door leaf:

- 1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
- 2. Where a wall stop cannot be used, provide universal floor stops for low- or high-rise options.
- 3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.16 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

- 1. Scheduled Manufacturer: Zero International
- 2. Acceptable Manufacturers: National Guard, Pemko

B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Size of thresholds:
 - a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
 - b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.17 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Rockwood, Trimco

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.18 FINISHES

A. FINISH: BHMA 626/652 (US26D); EXCEPT:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Overhead Stops and Holders: BHMA 630 (US32D)
6. Door Closers: Powder Coat to Match
7. Wall Stops: BHMA 630 (US32D)
8. Latch Protectors: BHMA 630 (US32D)
9. Weatherstripping: Clear Anodized Aluminum
10. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Where on-site modification of doors and frames is required:
 - 1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
 - 2. Field modify and prepare existing door and frame for new hardware being installed.
 - 3. When modifications are exposed to view, use concealed fasteners, when possible.
 - 4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
 - a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
 - b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
 - c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent,

unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

- H. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as indicated in keying section.
- I. Wiring: Coordinate with Division 26, ELECTRICAL sections for:
 - 1. Conduit, junction boxes and wire pull.
 - 2. Connections to and from power supplies to electrified hardware.
 - 3. Connections to fire/smoke alarm system and smoke evacuation system.
 - 4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
 - 5. Testing and labeling wires with Architect's opening number.
- J. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- K. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.
- L. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- M. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
 - 1. Coordination: Coordinate provision with the security systems provider to mitigate excessive or redundant purchase.
 - 2. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.
- N. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- O. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard. Locate no more than 4 inches from walls.
- P. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- Q. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- R. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for

final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

- A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.7 DOOR HARDWARE SCHEDULE

- A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.
- B. Do not order material until submittal has been reviewed, stamped, and signed by Architect's door hardware consultant.
- C. Hardware Sets: See below.

PART 4 - ABBREVIATION	Name
B/O	By Others
GLY	Glynn-Johnson Corp
IVE	H.B. Ives
KEE	Keedex Inc
LCN	LCN Commercial Division
SCE	Schlage Electronic Security
SCH	Schlage Lock Company
TBD	Manufacturer To Be Determined
VON	Von Duprin
ZER	Zero International Inc

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 Link to catalog cut sheet

 Electrified Opening

Hardware Group No. 01

For use on Door #(s):

5

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
2	EA	POWER TRANSFER	EPT10 CON		 689	VON
1	EA	ELEC PANIC HARDWARE	RX-9849-EO-CON		 626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9849-L-06-CON 24 VDC		 626	VON
1	EA	SFIC RIM CYLINDER	80-159		626	SCH
1	EA	SFIC CORE	TO MATCH EXISTANT VERIFY KEYWAY		626	TBD
2	EA	SURFACE CLOSER	4040XP SCUSH (PROVIDE MOUNTING BRACKETS, PLATES, AND ACCESSORIES AS REQ'D)		689	LCN
1	EA	RAIN DRIP	142A (OMIT IF SHELTERED)		AA	ZER
1	SET	MEETING STILE	326AA-S		AA	ZER
1	SET	GASKETING	50AA-S		AA	ZER
2	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	545A (OR AS DETAILED)		A	ZER
2	EA	WIRE HARNESS (DOOR)	CON XX-XX			VON
2	EA	WIRE HARNESS (FRAME)	CON-6W			VON
2	EA	DOOR CONTACT	679-05		 BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC COORDINATE W/ SECURITY CONTRACTOR			VON
1	EA	CARD/ CREDENTIAL READER	BY SECURITY CONTRACTOR COORDINATE W/ SECURITY CONTRACTOR			B/O

*COORDINATION ITEMS: POWER/ CONDUIT/ WIRING/ ELECTRONIC SECURITY SYSTEM.

*ACCESS CONTROL EQUIPMENT, DIAGRAMS, DOOR CONTACT, WIRING DOOR AND
FRAME CONNECTOR BY SECURITY CONTRACTOR.

*INSTALL DOOR SEAL BEFORE CLOSERS.

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Hardware Group No. 02

For use on Door #(s):

7 8

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	PANIC HARDWARE	AX-98-L-06		626	VON
1	EA	SFIC RIM CYLINDER	80-159		626	SCH
1	EA	SFIC CORE	TO MATCH EXISTANT VERIFY KEYWAY		626	TBD
1	EA	SURFACE CLOSER	4040XP REG OR PA (AS REQ'D)		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-NH-A		630	IVE
1	EA	WALL/ FLOOR STOP	WS406/407CVX / FS436 (AS REQ'D)		630	IVE
1	EA	GASKETING	188SGY PSA		Gy	ZER
1	EA	DOOR BOTTOM	360AA (AS REQ'D)		AA	ZER

Hardware Group No. 03

For use on Door #(s):

11

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	L9080HD 06A VERIFY KEY SYSTEM FORMAT		626	SCH
1	EA	SFIC CORE	TO MATCH EXISTANT VERIFY KEYWAY		626	TBD
1	EA	SURFACE CLOSER	4040XP REG OR PA (AS REQ'D)		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-NH-A		630	IVE
1	EA	WALL/ FLOOR STOP	WS406/407CVX / FS436 (AS REQ'D)		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

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Hardware Group No. 04

For use on Door #(s):

9

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	L9080HD 06A VERIFY KEY SYSTEM FORMAT		626	SCH
1	EA	SFIC CORE	TO MATCH EXISTANT VERIFY KEYWAY		626	TBD
1	EA	SURFACE CLOSER	4040XP H WMS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS		630	IVE
1	EA	WALL/ FLOOR STOP	WS406/407CVX / FS436 (AS REQ'D)		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

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Hardware Group No. 05

For use on Door #(s):

14 15

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
1	EA	POWER TRANSFER	EPT10 CON		⚡ 689	VON
1	EA	EU MORTISE LOCK	L9092HDEU 06A RX CON 12/24 VDC		⚡ 626	SCH
1	EA	SFIC CORE	VERIFY KEY SYSTEM FORMAT TO MATCH EXISTANT VERIFY KEYWAY		626	TBD
1	EA	LOCK GUARD	LG12		630	IVE
1	EA	SURFACE CLOSER	4040XP SCUSH (PROVIDE MOUNTING BRACKETS, PLATES, AND ACCESSORIES AS REQ'D)		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS (PUSH SIDE/ INGRESS)		630	IVE
1	EA	RAIN DRIP	142A (OMIT IF SHELTERED)		AA	ZER
1	SET	GASKETING	50AA-S		AA	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	545A (OR AS DETAILED)		A	ZER
1	EA	WIRE HARNESS (DOOR)	CON XX-XX			VON
1	EA	WIRE HARNESS (FRAME)	CON-6W			VON
1	EA	DOOR CONTACT	679-05		⚡ BLK	SCE
1	EA	CARD/ CREDENTIAL READER	BY SECURITY CONTRACTOR COORDINATE W/ SECURITY CONTRACTOR		⚡	B/O
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR COORDINATE W/ SECURITY CONTRACTOR		⚡	B/O

*COORDINATION ITEMS: POWER/CONDUIT/WIRING/ACCESS CONTROL SYSTEM.

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Hardware Group No. 06

For use on Door #(s):

10

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	5BB1HW 4.5 X 4.5		630	IVE
1	EA	PUSH PLATE	8200 4" X 16"		630	IVE
1	EA	PULL PLATE	8302 10" 4" X 16"		630	IVE
1	EA	SURFACE CLOSER	4040XP REG OR PA (AS REQ'D)		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS		630	IVE
1	EA	WALL/ FLOOR STOP	WS406/407CVX / FS436 (AS REQ'D)		630	IVE
1	EA	GASKETING	188SGY PSA		Gy	ZER

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Hardware Group No. AL-01

For use on Door #(s):

1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10 CON	 ⚡	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QELX-AX-35A-NL-OP-388- CON	 ⚡	626	VON
1	EA	SFIC RIM CYLINDER	80-159		626	SCH
1	EA	SFIC CORE	TO MATCH EXISTANT VERIFY KEYWAY		626	TBD
1	EA	90 DEG OFFSET PULL	8190EZHD 12"		630- 316	IVE
1	EA	SURF. AUTO OPERATOR	9540 SERIES	 ⚡	ANDK B	LCN
2	EA	ACTUATOR KIT	8310-3836T	 ⚡	689	LCN
1	EA	FLOOR STOP	FS18S/FS18L		BLK	IVE
1	EA	RAIN DRIP	142A (OMIT IF SHELTERED)		AA	ZER
1	SET	GASKETING AND SEAL	BY STOREFRONT MFG./SUPPLIER. TO MATCH DOOR HARDWARE		TBD	B/O
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	545A (OR AS DETAILED)		A	ZER
1	EA	WIRE HARNESS (DOOR)	CON XX-XX			VON
1	EA	WIRE HARNESS (FRAME)	CON-6W			VON
1	EA	DIAGRAM	PROVIDE ELEVATION DIAGRAM	⚡		B/O
1	EA	DIAGRAM	PROVIDE FACTORY POINT TO POINT WIRING DIAGRAM	⚡		B/O
1	EA	DOOR CONTACT	7764	 ⚡	628	SCE
1	EA	POWER SUPPLY	PS902 900-4RL 900-BBK 120/240 VAC	 ⚡		VON
1	EA	CARD/ CREDENTIAL READER	BY SECURITY CONTRACTOR COORDINATE W/ SECURITY CONTRACTOR	⚡		B/O

*COORDINATION ITEMS: POWER/ CONDUIT/ WIRING/ ELECTRONIC SECURITY SYSTEM.

OPERATION DESCRIPTION:

DOOR NORMALLY CLOSED AND LOCKED.

ENTRY BY VALID CREDENTIAL AT CARD READER OR BY KEY OVER-RIDE.

RX MOTION SENSOR SHUNTS DOOR FORCED OPEN IN ACCESS CONTROL SYSTEM.

INTERIOR ACTUATOR TO START OPENING CYCLE (UNLESS ADO IS POWERED OFF)

EXTERIOR ACTUATOR WIRED IN SERIES THROUGH ACCESS CONTROL SYSTEM AUX
RELAY SUCH THAT ON VALID CARD OR TIME ZONE CONTROL THE ACTUATOR CAN BE
PRESSED TO START OPENING CYCLE.

KEY OVER-RIDE WILL CAUSE DOOR FORCED EVENT IN ACCESS CONTROL SYSTEM.

FREE EGRESS AT ALL TIMES.

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Hardware Group No. AL-02

For use on Door #(s):

6

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	112XY EPT		628	IVE
2	EA	POWER TRANSFER	EPT10 CON	 ⚡	689	VON
1	EA	ELEC PANIC HARDWARE	RX-3549A-EO-CON	 ⚡	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-3549A-T-360T-CON 24 VDC	 ⚡	626	VON
1	EA	SFIC MORTISE CYLINDER	80-132		626	SCH
1	EA	SFIC CORE	TO MATCH EXISTANT VERIFY KEYWAY		626	TBD
2	EA	90 DEG OFFSET PULL	8190EZHD 12"		630- 316	IVE
1	EA	SURF. AUTO OPERATOR	9553 REG2 LESS TRACK AS REQ (120/240 VAC)	 ⚡	ANCL R	LCN
2	EA	ACTUATOR KIT	8310-3836T	 ⚡	689	LCN
1	EA	RAIN DRIP	142A (OMIT IF SHELTERED)		AA	ZER
1	SET	GASKETING AND SEAL	BY STOREFRONT MFG./SUPPLIER. TO MATCH DOOR HARDWARE		TBD	B/O
2	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	545A (OR AS DETAILED)		A	ZER
2	EA	WIRE HARNESS (DOOR)	CON XX-XX			VON
2	EA	WIRE HARNESS (FRAME)	CON-6W			VON
1	EA	DIAGRAM	PROVIDE ELEVATION DIAGRAM		⚡	B/O
1	EA	DIAGRAM	PROVIDE FACTORY POINT TO POINT WIRING DIAGRAM		⚡	B/O
2	EA	DOOR CONTACT	7764	 ⚡	628	SCE
1	EA	POWER SUPPLY	PS902 900-4RL 900-BBK 120/240 VAC	 ⚡		VON
1	EA	CARD/ CREDENTIAL READER	BY SECURITY CONTRACTOR COORDINATE W/ SECURITY CONTRACTOR		⚡	B/O

*COORDINATION ITEMS: POWER/CONDUIT/WIRING/ACCESS CONTROL SYSTEM.

OPERATION DESCRIPTION:

DOOR NORMALLY CLOSED AND LOCKED.

ENTRY BY VALID CREDENTIAL AT CARD READER OR BY KEY OVER-RIDE.

RX MOTION SENSOR SHUNTS DOOR FORCED OPEN IN ACCESS CONTROL SYSTEM.

INTERIOR ACTUATOR TO START OPENING CYCLE (UNLESS ADO IS POWERED OFF)

EXTERIOR ACTUATOR WIRED IN SERIES THROUGH ACCESS CONTROL SYSTEM AUX
RELAY SUCH THAT ON VALID CARD OR TIME ZONE CONTROL THE ACTUATOR CAN BE
PRESSED TO START OPENING CYCLE.

KEY OVER-RIDE WILL CAUSE DOOR FORCED EVENT IN ACCESS CONTROL SYSTEM.

FREE EGRESS AT ALL TIMES.

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Hardware Group No. AL-03

For use on Door #(s):

2

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	112XY EPT		628	IVE
2	EA	POWER TRANSFER	EPT10 CON	 ⚡	689	VON
1	EA	ELEC PANIC HARDWARE	RX-3549A-EO-CON	 ⚡	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-3549A-T-360T-CON 24 VDC	 ⚡	626	VON
1	EA	SFIC RIM CYLINDER	80-159		626	SCH
1	EA	SFIC CORE	TO MATCH EXISTANT VERIFY KEYWAY		626	TBD
2	EA	90 DEG OFFSET PULL	8190EZHD 12"		630- 316	IVE
1	EA	OH STOP	100S		630	GLY
2	EA	SURFACE CLOSER	4040XP EDA WMS (PROVIDE MOUNTING BRACKETS, SPACERS AND PLATES AS REQ'D)		689	LCN
1	EA	RAIN DRIP	142A (OMIT IF SHELTERED)		AA	ZER
1	SET	GASKETING AND SEAL	BY STOREFRONT MFG./SUPPLIER. TO MATCH DOOR HARDWARE		TBD	B/O
2	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	545A (OR AS DETAILED)		A	ZER
2	EA	WIRE HARNESS (DOOR)	CON XX-XX			VON
2	EA	WIRE HARNESS (FRAME)	CON-6W			VON
2	EA	DOOR CONTACT	7764	 ⚡	628	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC COORDINATE W/ SECURITY CONTRACTOR	 ⚡		VON
1	EA	CARD/ CREDENTIAL READER	BY SECURITY CONTRACTOR COORDINATE W/ SECURITY CONTRACTOR	⚡		B/O

*COORDINATION ITEMS: POWER/CONDUIT/WIRING/ACCESS CONTROL SYSTEM.

*CONFIRM THE SPECIFIED HARDWARE WILL MEET REQUIRED MINIMUM STC 40.

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Hardware Group No. AL-04

For use on Door #(s):

3

4

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10 CON	 ⚡	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QELX-AX-35A-NL-OP-388- CON	 ⚡	626	VON
1	EA	SFIC RIM CYLINDER	80-159		626	SCH
1	EA	SFIC CORE	TO MATCH EXISTANT VERIFY KEYWAY		626	TBD
1	EA	90 DEG OFFSET PULL	8190EZHD 12"		630- 316	IVE
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA WMS (PROVIDE MOUNTING BRACKETS, SPACERS AND PLATES AS REQ'D)		689	LCN
1	EA	RAIN DRIP	142A (OMIT IF SHELTERED)		AA	ZER
1	SET	GASKETING AND SEAL	BY STOREFRONT MFG./SUPPLIER. TO MATCH DOOR HARDWARE		TBD	B/O
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	545A (OR AS DETAILED)		A	ZER
1	EA	WIRE HARNESS (DOOR)	CON XX-XX			VON
1	EA	WIRE HARNESS (FRAME)	CON-6W			VON
1	EA	DOOR CONTACT	7764	 ⚡	628	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC COORDINATE W/ SECURITY CONTRACTOR	 ⚡		VON
1	EA	CARD/ CREDENTIAL READER	BY SECURITY CONTRACTOR COORDINATE W/ SECURITY CONTRACTOR	⚡		B/O

*COORDINATION ITEMS: POWER/ CONDUIT/ WIRING/ ELECTRONIC SECURITY SYSTEM.

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Hardware Group No. AL-05

For use on Door #(s):

16

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10 CON	 ⚡	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QELX-AX-35A-NL-OP-388- CON	 ⚡	626	VON
1	EA	SFIC RIM CYLINDER	80-159		626	SCH
1	EA	SFIC CORE	TO MATCH EXISTANT VERIFY KEYWAY		626	TBD
1	EA	90 DEG OFFSET PULL	8190EZHD 12"		630- 316	IVE
1	EA	SURFACE CLOSER	4040XP EDA WMS (PROVIDE MOUNTING BRACKETS, SPACERS AND PLATES AS REQ'D)		689	LCN
1	EA	FLOOR STOP	FS18S/FS18L		BLK	IVE
1	EA	RAIN DRIP	142A (OMIT IF SHELTERED)		AA	ZER
1	SET	GASKETING AND SEAL	BY STOREFRONT MFG./SUPPLIER. TO MATCH DOOR HARDWARE		TBD	B/O
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	545A (OR AS DETAILED)		A	ZER
1	EA	WIRE HARNESS (DOOR)	CON XX-XX			VON
1	EA	WIRE HARNESS (FRAME)	CON-6W			VON
1	EA	DOOR CONTACT	7764	 ⚡	628	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC COORDINATE W/ SECURITY CONTRACTOR	 ⚡		VON
1	EA	CARD/ CREDENTIAL READER	BY SECURITY CONTRACTOR COORDINATE W/ SECURITY CONTRACTOR	⚡		B/O

*COORDINATION ITEMS: POWER/ CONDUIT/ WIRING/ ELECTRONIC SECURITY SYSTEM.

*FOR DOOR CLOSER: PROVIDE MOUNTING BRACKETS, SPACERS AND PLATES AS
REQUIRED.

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Hardware Group No. AL-06

For use on Door #(s):

12

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10 CON	 ⚡	689	VON
1	EA	EU MORTISE LOCK	L9092HDEU 06A RX CON 12/24 VDC	 ⚡	626	SCH
1	EA	SFIC CORE	VERIFY KEY SYSTEM FORMAT TO MATCH EXISTANT VERIFY KEYWAY		626	TBD
1	EA	SURFACE CLOSER	4040XP REG OR PA (PROVIDE MOUNTING BRACKETS, SPACERS AND PLATES AS REQ'D)		689	LCN
1	EA	FLOOR STOP	FS436/438 -AS REQ		626	IVE
1	SET	GASKETING AND SEAL	BY STOREFRONT MFG./SUPPLIER. TO MATCH DOOR HARDWARE		TBD	B/O
1	EA	WIRE HARNESS (DOOR)	CON XX-XX			VON
1	EA	WIRE HARNESS (FRAME)	CON-6W			VON
1	EA	DOOR CONTACT	679-05	 ⚡	BLK	SCE
1	EA	CARD/ CREDENTIAL READER	BY SECURITY CONTRACTOR COORDINATE W/ SECURITY CONTRACTOR	⚡		B/O
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR COORDINATE W/ SECURITY CONTRACTOR	⚡		B/O

*COORDINATION ITEMS: POWER/CONDUIT/WIRING/ACCESS CONTROL SYSTEM.

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Hardware Group No. AL-07

For use on Door #(s):

13

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050HD 06A L583-363		626	SCH
1	EA	SFIC CORE	TO MATCH EXISTANT VERIFY KEYWAY		626	TBD
1	EA	WALL/ FLOOR STOP	WS406/407CVX / FS436 (AS REQ'D)		630	IVE
1	SET	GASKETING AND SEAL	BY STOREFRONT MFG./SUPPLIER. TO MATCH DOOR HARDWARE		TBD	B/O

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Hardware Group No. GATE-01

For use on Door #(s):

18

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	SET	SELF CLOSING HINGES/ PIVOTS	BY GATE MFG./ SUPPLIER		626	B/O
1	EA	DOOR CORD	788-18 LESS WIRES	 ⚡	626	SCE
1	EA	ELEC PANIC HARDWARE	RX-LC-OUT-AX-98-L-M996-06-FSE-ALK-CON 9-VOLT BATTERY WITH HARDWIRED OPTION	 ⚡	626	VON
1	EA	SFIC MORTISE CYLINDER	80-132		626	SCH
1	EA	SFIC RIM CYLINDER	80-159		626	SCH
2	EA	SFIC CORE	TO MATCH EXISTANT VERIFY KEYWAY		626	TBD
1	EA	WELDED GATE BOX	GATE BOX FOR LOCKING DEVICE BY GATE MFG.		TBD	KEE
1	EA	FLOOR STOP	FS18S/FS18L		BLK	IVE
1	EA	WIRE HARNESS (DOOR)	CON XX-XX			VON
1	EA	WIRE HARNESS (FRAME)	CON-6W			VON
1	EA	DOOR CONTACT	679-05 (OR BY GATE MFG.)	 ⚡	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-FA 900-4RL 900-BBK 120/240 VAC	 ⚡		VON
1	SET	BALANCE OF GATE HARDWARE	BY GATE DOOR MFG./ SUPPLIER		TBD	B/O
2	EA	CARD/ CREDENTIAL READER	BY SECURITY CONTRACTOR COORDINATE W/ SECURITY CONTRACTOR	⚡		B/O

*PIVOTS, WELDABLE GATE BOX FOR LOCK, CLOSER AND BALANCE OF HARDWARE BY GATE MFG./ SUPPLIER.

*CONFIRM HARDWARE WITH GATE MFG./ SUPPLIER PRIOR TO ORDERING.

*PROVIDE MOUNTING PLATES (AS REQ'D)

DOOR OPERATION:

DOOR NORMALLY CLOSED AND LOCKED.

DOOR ACCESS FROM EXTERIOR TO LIBRARY OUTER SPACE; THROUGH AUTHORIZED CARD READER.

DOOR EGRESS FROM LIBRARY OUTER SPACE TO EXTERIOR, THROUGH AUTHORIZED CARD READER.

THE UNAUTHORIZED PANIC BAR ACTIVATION WILL CAUSE ALARM TO SOUND; ALARM WILL CONTINUE TO SOUND UNTIL SYSTEM IS MANUALLY RESET.

UPON POWER LOSS OR FIRE ALARM SIGNAL, THE ACCESS CONTROL SYSTEM TO DISENGAGE ALLOWING FREE EGRESS

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Hardware Group No. GATE-02

For use on Door #(s):

19

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	SET	SELF CLOSING HINGES/ PIVOTS	BY GATE MFG./ SUPPLIER		626	B/O
2	EA	DOOR CORD	788-18 LESS WIRES		✓ 626	SCE
1	EA	ELEC PANIC HARDWARE	RX-LC-OUT-AX-98-EO-ALK-CON 9-VOLT BATTERY WITH HARDWIRED OPTION		✓ 626	VON
1	EA	ELEC PANIC HARDWARE	RX-LC-OUT-AX-98-L-M996-06-FSE-ALK-CON 9-VOLT BATTERY WITH HARDWIRED OPTION		✓ 626	VON
1	EA	SFIC MORTISE CYLINDER	80-132		626	SCH
2	EA	SFIC RIM CYLINDER	80-159		626	SCH
3	EA	SFIC CORE	TO MATCH EXISTANT VERIFY KEYWAY		626	TBD
1	EA	WELDED GATE BOX	GATE BOX FOR LOCKING DEVICE BY GATE MFG.		TBD	KEE
2	EA	FLOOR STOP	FS18S/FS18L		BLK	IVE
2	EA	WIRE HARNESS (DOOR)	CON XX-XX			VON
2	EA	WIRE HARNESS (FRAME)	CON-6W			VON
2	EA	DOOR CONTACT	679-05 (OR BY GATE MFG.)		✓ BLK	SCE
1	EA	POWER SUPPLY	PS902 900-FA 900-4RL 900-BBK 120/240 VAC		✓	VON
1	SET	BALANCE OF GATE HARDWARE	BY GATE DOOR MFG./ SUPPLIER		TBD	B/O
2	EA	CARD/ CREDENTIAL READER	BY SECURITY CONTRACTOR COORDINATE W/ SECURITY CONTRACTOR	✓		B/O

*PIVOTS, WELDABLE GATE BOX FOR LOCK, CLOSER AND BALANCE OF HARDWARE BY GATE MFG./ SUPPLIER.

*CONFIRM HARDWARE WITH GATE MFG./ SUPPLIER PRIOR TO ORDERING.

*PROVIDE CENTER POST FOR PANIC HARDWARE.

*PROVIDE MOUNTING PLATES (AS REQ'D)

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DOOR OPERATION:

DOOR NORMALLY CLOSED AND LOCKED.

DOOR ACCESS FROM EXTERIOR TO LIBRARY OUTER SPACE; THROUGH AUTHORIZED CARD READER.

DOOR EGRESS FROM LIBRARY OUTER SPACE TO EXTERIOR, THROUGH AUTHORIZED CARD READER.

THE UNAUTHORIZED PANIC BAR ACTIVATION WILL CAUSE ALARM TO SOUND; ALARM WILL CONTINUE TO SOUND UNTIL SYSTEM IS MANUALLY RESET.

UPON POWER LOSS OR FIRE ALARM SIGNAL, THE ACCESS CONTROL SYSTEM TO DISENGAGE ALLOWING FREE EGRESS

Hardware Group No. RU-1

For use on Door #(s):

17

Provide each RU door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	WON DOOR HORIZONTAL FIRE GUARD DOOR C/W HARDWARE	BY DOOR MFG./ SUPPLIER TO MATCH DOOR HARDWARE	TBD	B/O

*WON DOOR HORIZONTAL FIRE GUARD DOOR C/W HARDWARE BY DOOR MFG./ SUPPLIER.

DOOR INDEX:

Door#	HW Set#
1✓	AL-01
2✓	AL-03
3✓	AL-04
4✓	AL-04
5✓	01
6✓	AL-02
7	02
8	02
9	04
10	06
11	03
12✓	AL-06
13	AL-07
14✓	05
15✓	05
16✓	AL-05
17	RU-1
18✓	GATE-01
19✓	GATE-02

END OF SECTION

SECTION 08 71 15

LOW ENERGY DOOR OPERATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide low energy automatic door operators for swinging doors, with accessories as required for complete operational installation; system to open and close door upon receipt of an actuating signal.
- B. Related Sections:
 - 1. Section 08 41 00: Entrances and storefronts, including standard hardware.
 - 2. Division 26: Final electrical connections.

1.2 REFERENCES

- A. ANSI A156.19: Power Assist and Low Energy Power Operated Doors Standard.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate low energy door operators with doors, frames, door hardware, and surrounding construction.
- B. Pre-Installation Meeting: Convene not less than one week prior to commencing work of this Section. Require attendance of those directly affecting work of this Section.
 - 1. Review installation procedures and coordination required with related work.

1.4 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature and maintenance data.
- B. Shop Drawings: Indicate pertinent dimensioning, general construction, materials and finishes, component connections, anchorage methods and locations and hardware; indicate exposed fasteners for specific approval.
 - 1. Templates and Diagrams: Furnish templates, diagrams, and data necessary for proper installation of closers to fabricators of related work and coordinate.
- C. Samples: Furnish samples of each exposed finish.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Firm with minimum five years successful experience installing door operator units like type specified and acceptable to operator manufacturer.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Horton Automatics/Series 7000.
- B. LCN/4600 Series Electrically Powered Auto-Equalizer.
- C. Dor-O-Matic, Inc./Senior-Swing Automatic Operation.
- D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide low energy automatic door operators for swinging doors, with accessories.
- B. Regulatory Requirements: Comply with applicable codes.
 - 1. Power Failure: Doors shall not exceed 50-pounds force to set door in motion and shall not exceed 5 pounds force for pushing or pulling doors open when force applied to latch side of door.
- C. Performance Criteria: Provide operators complying with applicable portions of ANSI A156.19, designed for doors of types indicated to receive operators.
- D. System Description: Provide low energy automatic door operators for swinging doors, with accessories as required for complete operational installation; system to open and close door upon receipt of an actuating signal.
- E. Low Energy Door Operators: Complete operator system including door operator, controls, and attachment system designed for type of doors indicated and complying with requirements of ANSI A156.19 for low energy power operated door operators.
- F. Control: As indicated, as selected by Architect from manufacturer's full range of flush wall mounted push-button control units where not otherwise indicated.
 - 1. Provide controls on each side of every door with an operator; number, size, type, and location as indicated and as required by California Building Standards Code to ensure access for persons with disabilities.

2.3 FABRICATION

- A. Fabrication: Provide each automatic door operator as complete, shop fabricated unit.
 - 1. Complete the fabrication, assembly, finishing, application of hardware and other work before shipment, to greatest extent possible.
 - 2. Disassemble only to extent necessary of shipment and installation.
- B. Complete cutting, fitting, forming, drilling and grinding of metal work prior to cleaning and finishing. Remove arises from cut edges and ease edges and corners to radius of approximately 1/64".

- C. Conceal fasteners unless otherwise approved by Architect.
- D. Reinforce work as necessary for performance requirements, and for support to structure.
- E. Separate dissimilar metals with bituminous paint or preformed separators to prevent corrosion; separate metal surfaces at moving joints with non-metallic separators to prevent "freeze-up" of joints.
- F. Finish: Match entrance door finish as specified in Section 08 41 00 - Entrances and Storefronts.
- G. Special Features:
 - 1. Safety release clutch for obstructed closing and with checking for both opening and closing cycles.
 - 2. Interlocks: Electrical interlocks which prevent operation of doors when locked or latched.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which automatic doors are to be installed; do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's recommendations and installation instructions for installation of low energy door operators.
- B. Set plumb, level and true to line, without warp or rack of frames or doors; anchor securely in place.
 - 1. Separate aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- C. Install complete door operator system including controls, control wiring and power units.

3.3 ADJUSTING

- A. After operation of completed installation equivalent to three days use, readjust door operators and controls for optimum operating condition and safety.
- B. Lubricate operating equipment.

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Provide miscellaneous glass and glazing not provided elsewhere including accessories as required for complete installation.
 - a. Provide glazing for metal doors and frames.
 - b. Provide glazing for interior aluminum frames.
 - c. Provide glazing for wood doors.

B. Related Sections:

1. Section 08 41 00: Aluminum-framed entrances and storefronts glazing.
2. Section 08 44 10: Glazed window wall assemblies glazing.
3. Section 08 51 10: Aluminum window glazing.
4. Section 10 28 00: Metal framed mirrors.

1.2 REFERENCES

- A. Glass Association of North America (GANA): Glazing Manual and Sealant Manual.

1.3 SUBMITTALS

- A. Product Data: Furnish for each type of glass and exposed glazing material.
- B. Samples: Furnish samples of exposed glazing accessories.

1.4 WARRANTY

- A. Extended Correction Period: Extend correction period to two years for following.
1. Replacing laminated glass which exhibits signs of delaminating.
 2. Replacing insulated glass which exhibits signs of moisture on sealed glass surfaces.
 3. Replacing mirrors which exhibit signs of desilvering or signs of distortion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Description: Section includes miscellaneous glass and glazing materials for items typically furnished without glazing and where glazing is not an integral part of the assembly.
- B. Regulatory Requirements:
 - 1. Safety Glass Standard: Comply with applicable codes, CPSC 16 CFR 1201, and pass ANSI Z97.1.
 - 2. Fire Rated Glass: Provide glass identical to glass tested per ASTM E163, labeled and listed by UL or other testing and inspection agency acceptable to applicable authorities.
- C. Float Glass: Select glazing quality, clear annealed glass, ASTM C1036; nominal thickness 1/4".
 - 1. Manufacturers:
 - a. Vitro Architectural Glass (formerly PPG).
 - b. Oldcastle Glazing.
 - c. Guardian Industries Corp.
 - d. Substitutions: Refer to Section 01 25 00.
 - 2. Locations: Provide where indicated as clear glass.
- D. Tempered Glass: Select glazing quality, clear float glass, fully tempered, ASTM C1048, Kind FT; nominal thickness 1/4"; safety glass.
 - 1. Manufacturers:
 - a. Vitro Architectural Glass (formerly PPG).
 - b. Oldcastle Glazing.
 - c. Guardian Industries Corp.
 - d. Substitutions: Refer to Section 01 25 00.
 - 2. Locations: Provide at doors and at window openings where required by applicable codes and federal requirements.
- E. Insulated Glass: Preassembled units consisting of organically sealed panes of glass enclosing a hermetically sealed dehydrated air space with minus 20-degree F dew point.
 - 1. Manufacturers:
 - a. Vitro Architectural Glass (formerly PPG).
 - b. Oldcastle Glazing.
 - c. Guardian Industries Corp.
 - d. Viracon.
 - e. Substitutions: Refer to Section 01 25 00.

2. Performance: Certified to ASTM E2190 by Insulating Glass Certification Council.
3. System: Manufacturer's standard dual seal system compatible with glazing system, and including spacers, desiccant, and standard corner construction.
4. Glass: ASTM C1036, select glazing quality clear float glass; nominal 1/4" thick glass.
5. Safety Glass: ASTM C1048, Kind FT, fully tempered select glazing quality clear float glass; nominal 1/4" thick glass; provide at doors and impact areas where safety glass is required by applicable codes and regulations.
6. Total Unit Thickness: 1".
7. Locations: Provide at exterior windows and doors unless otherwise indicated.
- F. Spacer Shims: Silicone compatible, 50 durometer hardness; 3" long by 3/32" thick by 1/4" high.
- G. Setting Blocks: 70-90 durometer hardness; 4" long by 3/8" thick by 1/4" high standard setting blocks.
- H. Glazing Sealant: ASTM C920, Type S, Grade NS, elastomeric one-component silicone glazing sealants as recommended by sealant manufacturer for application involved.
 1. Manufacturers:
 - a. Dow Corning Corp.
 - b. General Electric Co.
 - c. Pecora Corp.
 - d. Substitutions: Refer to Section 01 25 00.
 2. Structural and Butt Glazing: Provide high-modulus structural silicone glazing materials recommended by sealant manufacturer for applications where sealant bonds glass to metal system and where sealant bonds glass to glass.
 3. Color: As selected by Architect from manufacturer's full range of available colors.
- I. Glazing Putty: Linseed oil putty, ASTM C570, Type II; oil and resin base caulking compound for building construction; knife grade.1.
 1. Manufacturers:
 - a. DAP, Inc.
 - b. Substitutions: Refer to Section 01 25 00.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean glazing channels and framing members to receive glass immediately before glazing; remove coatings not firmly bonded to substrate.

- B. Apply primer to joint surfaces where recommended by sealant manufacturer.

3.2 INSTALLATION

- A. Comply with GANA Glazing Manual and Sealant Manual and glazing manufacturer recommendations and installation instructions.
 - 1. Do not allow glass to touch metal surfaces.
 - 2. Comply with applicable code requirements and NFPA 80 for glass in fire rated openings.
- B. Place setting blocks at quarter points in thin course of sealant.
- C. Install removable stops with glass centered in space with spacer shims at 2'-0" intervals on both sides of glass, 1/4" below sightline.
- D. Sealant Glazing: Fill gap between glass and stops with sealant to depth equal to bite of frame on glass but not more than 3/8" below sightline.
 - 1. Apply sealant to uniform and level line, flush with sightline; tool or wipe sealant surface for smooth appearance; at exterior locations tool sealant so water is carried away from glass.

3.3 CLEANING

- A. At areas subject to potential impact mark glass after installation by crossed streamers attached to framing and held away from glass; do not apply markers to surface of glass.
- B. Remove nonpermanent labels immediately after sealant cures; cure sealants for high early strength and durability.
- C. Remove and replace glass which is broken, chipped, cracked, abraded or damaged during construction period, including natural causes, accidents and vandalism.

END OF SECTION

SECTION 08 91 00

LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide formed metal louvers and frames, with screens, attachment hardware, and accessories as required for complete finished installation.
- B. Related Sections:
 - 1. Section 08 11 10: Steel door louvers.

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature for each type of louver.
- B. Shop Drawings: Indicate profile of frame, details, relation to adjacent construction, flashing, blade configuration, duct work connection, screens, and percentage of free air opening.
- C. Samples: Furnish samples of metal finish.
- D. Certificates: Where performance requirements are included, provide AMCA Certified Rating Seal indicating louvers comply with requirements.

1.3 SITE CONDITIONS

- A. Take site dimensions affecting louvers prior to fabrication.
- B. Ensure openings are properly prepared and flashings are correctly located to divert moisture to exterior.
- C. Protect adjacent surfaces, finishes and materials from damage during installation of louvers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The Airolite Corporation.
- B. Construction Specialties, Inc. (CSI).
- C. Airline Products Co.
- D. Nystrom Building Products.
- E. Ruskin.

- F. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide formed metal louvers and frames, with screens, attachment hardware, and accessories.
- B. Performance Criteria: Where indicated, comply with specific performance requirements; unit performance ratings determined in compliance with Air Movement and Control Association (AMCA) Standard 500.
1. Free Area: Minimum 45% based on 48" by 48" louver.
 2. Static Pressure Loss: Maximum 0.15" of water gage at airflow of 1000 fpm free air velocity.
 3. Water Penetration: Maximum 0.05 oz/sf of free area at intake airflow of 1000 fpm free area velocity.
 4. Wind-Driven Rain: Louvers shall achieve a wind-driven rating in conformance with applicable codes and regulations but not less than an A rating on a standard size louver as defined in AMCA 500 - L.
- C. Steel Sheet: Minimum 16 gage steel, ASTM A924 and A653 with G90 galvanized coating, mill phosphatized.

2.1 FABRICATION

- A. Louvers: Manufacturer's standard fabrication for types specified and configurations indicated on Drawings.
1. Type: Sheet metal louvers formed of shapes as indicated; Contractor option aluminum sheet or galvanized steel sheet unless otherwise indicated.
- B. Bird Screen for Exterior Louvers: Minimum 0.063" diameter wire, 1/2" interwoven square mesh.
1. Wire: Stainless-steel.
 2. Frame: Match louver.
- C. Fabricate louvers to maximum extent possible and disassemble as necessary for shipping and handling limitations; clearly mark units for reassembly and installation.
1. Fabricate frames, including integral sills, to suit adjacent construction with tolerances for installation.
 2. Fabricate sill extension, flashings, wall anchors, structural supplementary sub-framing, and accessories as required for complete system; use same materials as provided for louvers.

- D. Join frame members and louver blades by welding; maintain equal blade spacing, including separation between blades and frame head and sill; maintain uniform appearance.
- E. Shop Primed Louvers: Manufacturer's standard thermosetting prime coating compatible with paints specified in Section 09 90 00 - Painting and Coating.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install louvers in accordance with manufacturer recommendations and installation instruction, properly aligned and level.
- B. Secure louver rigid with concealed fasteners of non-corrosive metals to suit materials being encountered and to resist anticipated loads.
- C. Coordinate installation method with application of adjacent backing and structural elements, and mechanical work.
- D. Set and tie into flashings to ensure diversion of moisture to exterior.
- E. Hinge screens for access.

END OF SECTION

SECTION 09 01 20

PLASTER PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Patch exterior Portland cement plaster to match existing.
2. Patch existing lath where deteriorated and where damaged during construction operations.

1.2 REFERENCES

- A. ASTM C841: Installation of Interior Lathing and Furring.
- B. ASTM C842: Application of Interior Gypsum Plaster.
- C. ASTM C926: Application of Portland Cement Based Plaster.
- D. ASTM C1063: Installation of Lathing and Furring For Portland Cement Plaster.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Meeting: Convene not less than one week prior to commencing work of this Section. Require attendance of those directly affecting work of this Section.
 1. Review installation procedures and coordination required with related work.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product specifications for each lathing material and accessory.
- B. Mock-Up: Provide mock-up of each type of plaster patching.

1.5 PROJECT CONDITIONS

- A. Take precautionary measures to ensure excessive temperature changes do not occur.
- B. Cold-Weather Requirements: Do not apply plaster unless minimum ambient temperature of 50 degrees F has been and continues to be maintained for minimum 48 hours prior to application and until plaster is cured.
- C. Hot-Weather Requirements: Protect plaster from uneven and excessive evaporation during hot, dry weather.
- D. Interior Plaster: Provide heat and ventilation in interior areas where plaster work is being performed, so as to allow plaster to properly cure.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Description: Provide materials for patching existing plaster systems including lath and accessories which are deteriorated, and which are damaged by construction operations including plaster patching.
- B. Regulatory Requirements: Where assemblies are fire rated, provide materials acceptable to applicable authorities for required fire ratings.
 - 1. Provide materials required for systems listed by Underwriters Laboratory, Gypsum Association (GA) File No's in GA-600 Fire Resistance Design Manual, or other listing approved by applicable authorities.
- C. Portland Cement Plaster: Provide either neat or ready-mixed (where applicable) materials, at Contractor's option, complying with ASTM C926.
 - 1. Basecoat Materials:
 - a. Cement: Normal Type 1 or 1A Portland cement, ASTM C150.
 - b. Lime: Special finishing hydrated lime, Type S, ASTM C206.
 - c. Aggregate: Natural sand, conforming to ASTM C897 or C144.
 - 2. Brown Coat Water Acrylic Admix: Acrylic latex admix specifically manufactured for use in Portland Cement Plaster applications and which will not detrimentally effect finish.
 - a. Manufacturers:
 - 1) Larsen Products Corp./Acrylic Admix 101.
 - 2) Thoro System Products, Inc./Acryl 60.
 - 3) Chem-Masters Corp./Cretelox.
 - 4) Substitutions: Refer to Section 01 25 00.
 - 3. Finishing Materials: Same as basecoat with acrylic admix. Factory premix finish coat is acceptable.
 - a. Provide white cement from a single manufacturer and clear silica sand at applications indicated to have integral color.
 - 4. Portland Cement Plaster Bonding Agents: ASTM C932 bonding agent as recommended by manufacturer for Portland cement exterior applications.
 - a. Manufacturers:
 - 1) Larsen Product Corp./Weld-Crete.
 - 2) Thoro System Products, Inc./Thorobond.
 - 3) Chem-Masters Corp./Polyweld.
 - 4) Substitutions: Refer to Section 01 25 00.

- D. Gypsum Plaster: Provide materials which result in surfaces matching adjacent existing surfaces, but no less than following.
 - 1. Basecoat Materials: Provide either neat or ready-mixed (where applicable) materials, complying with ASTM C28.
 - a. Cement: Provide either ready-mixed or neat gypsum plaster conforming to ASTM C28.
 - b. Lime: Normal finishing hydrated lime, ASTM C6.
 - c. Aggregate: Natural sand, conforming to ASTM C35; clean, washed, free from substances detrimental to plaster.
 - 2. Finishing Materials:
 - a. Cement: Keene's cement conforming to ASTM C61.
 - b. Lime: Special finishing hydrated lime, Type S, ASTM C206.
 - c. Aggregate: Clean white natural sand, conforming to ASTM C35; clean, washed, free from substances detrimental to plaster and capable of providing specified finish.
 - 3. Gypsum Plaster Bonding Agent: ASTM C631 bonding agent as recommended by manufacturer for gypsum cement applications.
 - a. Manufacturers:
 - 1) Larsen Product Corp./Plaster-Weld.
 - 2) H.B. Fuller/Ful-O-Mite BC-316.
 - 3) Substitutions: Refer to Section 01 25 00.
- E. Molding Plaster: ASTM C59, plaster of Paris.
 - 1. Moldings and Decorations: Replicate, repair and restore or move existing decorative moldings, applied panels, grooving and cast decorations.
 - 2. Cast decorative elements from molds prepared from existing decorations; strip and clean existing decorations to produce clean, sharp molds.
- F. Water: Clean, fresh and free from injurious amounts of oil, acid, alkali, salts, minerals, organic matter or other deleterious substances.
- G. Integral Color: Pure, non-fading, mineral oxide color conforming to ASTM C979 and designed and mixed to provide uniform color finish coat.
 - 1. Color: As selected by Architect and as required to produce final color of plaster to match existing plaster; custom color may be required.

- H. Lathing Materials and Accessories: Comply with requirements of referenced ASTM standards and applicable code requirements.
1. Manufacturers:
 - a. ClarkDietrich Building Systems.
 - b. Phillips Manufacturing Co.
 - c. Alabama Metal Industries Corp. (AMICO).
 - d. Keene Products from Metalex, a Division of The Koller Group.
 - e. Delta Star, Inc., Superior Metal Trim.
 - f. Substitutions: Refer to Section 01 25 00.
 2. Metal Components:
 - a. Exterior Concealed Components: Hot-dipped galvanized, ASTM A653 minimum G90 for 18 gage and lighter formed metal products, ASTM A123 galvanized after fabrication for 16 gage and heavier products.
 - b. Exterior Exposed Components: Zinc accessories unless fully concealed in plaster.
 - c. Interior Components: Rust-inhibitive paint may be used in lieu of galvanizing other than in areas of potential high humidity.
 3. Metal Lath: Self-furring type where over solid substrate.
 - a. Typical: Expanded diamond mesh, minimum 2.5 lbs. per square yard.
 - b. Soffits: Expanded diamond mesh, minimum 3.4 lbs per square yard; provide ribbed lath where spanning between supports.
 - c. Tie Wire: ASTM A641, soft temper, Class 1 zinc coated; minimum 16 gage for tying metal lath to furring channels and metal lath to metal lath.
 4. Gypsum Lath: ASTM C37, Type X with core having increased fire-retardant properties; 1/2" thick unless otherwise indicated.
 5. Inside Corner Mesh: Minimum 26 gage steel; perforated or expanded flanges or clips shaped to permit complete embedding in plaster; minimum 3" x 3" size.
 6. Anchorages: Tie wire, nails, screws and other approved metal supports, of type and size to suit application.
 7. Accessories: Provide as required for complete plaster patching, replace components which are damaged; match existing; conform to recommendations of referenced standards.
 - a. Casing Beads and Base Screeds: Minimum 26 gage, square edges at casing beads; provide with expanded flanges.
 - b. Expansion and Control Joints: Match existing.

2.2 PLASTER MIXES

- A. Provide Portland cement plaster mixes in accordance with ASTM C926 as appropriate to substrate indicated and approved samples.
- B. Provide gypsum plaster in accordance with ASTM C842 as appropriate for patching existing interior plaster.
- C. Mix only as much plaster as can be used in one hour.
- D. Mix materials dry, to uniform color and consistency, before adding water.
- E. Protect mixes from frost, dust and evaporation.
- F. Do not retemper mixes after initial set has occurred.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify climatic and surface conditions are satisfactory.
- B. Do not commence installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Preparation of Existing Plaster: Remove deteriorated plaster, cut back to sound plaster and back bevel remaining plaster edges, route cracks to scratch coat and bevel plaster edges.
 - 1. Apply bonding agent to existing plaster in accordance with bonding agent manufacturer's recommendations.
 - a. Gypsum Plaster: Prepare surfaces for direct bonding of gypsum plaster; conform to ASTM C843 for preparation and application of bonding agent and application of plaster over bonding agent.
 - 2. Remove and replace lathing which is rusted or damaged; remove sufficient plaster to allow firm wire tie bond of new lathing to existing undamaged lathing.
 - a. Metal Lath: Apply metal lath taut, with long dimension perpendicular to supports; secure end laps with tie wire where they occur between supports; lap sides minimum 1-1/2"; secure with tie wires.
 - b. Gypsum Lath: Attach gypsum lath to framing with screws; attach with resilient clips where plaster is part of sound rated partitions.
 - 3. Where efflorescence or stains are evident, ensure cause of moisture in back-up materials has been eliminated.

- B. Installation of New Metal Accessories: Fasten in place true to line and in correct relation to adjacent materials and as to prevent dislodging and misalignment by subsequent operations. Fasten at both ends and at maximum 12" on center.
 - 1. Bring grounding edge of accessories to true lines, plumb, level, and straight.
 - 2. Install accessories to provide required depth of plaster and to bring plaster surface to required plane.
 - 3. Install continuous corner reinforcement for full length of external corners.
 - 4. Beads: Use single length of metal beads wherever length of run does not exceed longest standard stock length available; miter or cope corners.
 - a. Provide casing beads where plaster abuts dissimilar construction and at perimeter of openings where edges of plaster will not be concealed by other work.

3.3 PATCHING PORTLAND CEMENT PLASTER

- A. Remove surface deposits on plaster with dry brush and wipe affected areas with damp cloth.
- B. General: At major repair areas conform to ASTM C926.
 - 1. Apply cement plaster using three coats unless otherwise required to match existing.
 - 2. Apply each base coat to minimum thickness of 3/8"; allow each coat to slowly dry for minimum period of 48 hours;
 - a. Moist cure first base coat (scratch coat) during 48 hour period.
 - 3. Allow base coats to cure for minimum 7 days prior to application of finish coat.
 - 4. Evenly dampen base coat, to ensure uniform suction, and apply finish coat; apply thickness sufficient to secure required texture but in no case less than 1/8".
 - a. Apply pre-mixed finish coat in accordance with manufacturer's recommendations.
 - 5. Maintain surface flatness, with maximum variation of 1/8" in 10'-0".
 - 6. Avoid excessive working of surface, delay trowelling as long as possible to avoid drawing excess fines to surface.
 - 7. Finish: Provide surfaces with finish to match existing.
- C. Repairing Portland Cement Plaster: Repair major and minor damage to cement plaster (stucco).
 - 1. For sound cement plaster, having small cracks or other cosmetic blemishes, clean entire surface of existing plaster with detergent, and rinse with clear water.

- a. If surface has been painted, remove paint.
 - b. Over one or two coats of sound condition paint, after washing and rinsing surface apply one coat of bonding agent tested and compatible with paint.
 - c. Apply finish coat of Portland cement stucco to thickness of approximately 1/8", and texture as required to match adjacent plaster finish.
 - d. Take special precautions to ensure temperature of material is maintained at 50 degrees F. during, and for not less than, 48 hours after application.
2. For unsound cement plaster, where segments have become detached from back-up base, remove unsound areas, and verify condition of back-up or base.
- a. Replace damaged lath or lath without sufficient mechanical bond with new self-furring galvanized metal lath.
 - b. If back-up is concrete or masonry, clean it completely of old cement plaster and apply one coat of bonding agent.
 - c. Apply scratch coat to back-up or base; scratch horizontally for proper bond with brown coat; cure for minimum 48 hours.
 - d. Apply brown and finish coats as required for general Portland cement plaster.
 - e. Texture finish coat as required to match existing.
3. For large cracks in cement plaster, undercut edges on both sides of cracks to back-up material or base; dry brush cracks clean.
- a. Apply coat of bonding agent to surfaces of damaged area; mix and apply scratch, brown and finish coats as specified.
 - b. .

3.4 CLEANING

- A. Promptly remove plaster from surfaces not indicated to be plastered.
- B. Repair other surfaces damaged by plaster patching operations to original undamaged condition as approved by Architect.

3.5 PROTECTION

- A. Protect surfaces from stains, marring, and other damage; repair stained, marred and damaged surfaces prior to Substantial Completion.

END OF SECTION

SECTION 09 21 00

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide gypsum board systems including gypsum board, joint treatment, acoustical accessories, and general accessories for complete installation.
- B. Related Sections:
 - 1. Section 07 21 00: Building thermal insulation.
 - 2. Section 07 84 00: Firestopping.
 - 3. Section 09 30 00: Cementitious backer unit tile substrates.

1.2 REFERENCES

- A. ASTM C840: Application and Finishing of Gypsum Board.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination,
 - 1. Openings: Obtain dimensions and locations from other trades and provide openings and enclosures for accessories, specialties, equipment, and ductwork.
 - 2. Large Format Tile: Tile Council of North America (TCNA) requires framing at large format tile to be maximum 16" on center and for maximum deflection of L/720 where large format tile as defined by TCNA is indicated.

1.4 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature for framing, insulation, gypsum board, and acoustical accessories.
- B. Samples: Submit samples of special texture finish.
- C. Manufacturer's Certification: Furnish manufacturer's certification indicating products comply with Contract Documents and applicable codes.

1.5 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives, sealants, and caulks.
- B. Level 4 Finish Mock-Up: Provide Level 4 finish mock-up not less than 100 square feet in location acceptable to Architect. Approved mock-up may be incorporated into Project.

1.6 PROJECT CONDITIONS

- A. Do not begin installation of interior gypsum board until space is enclosed, space is not exposed to other sources of water, and space is free of standing water.
- B. Maintain areas to receive gypsum board at minimum 50-degree F for 48 hours prior to application and continuously after application until drying of joint compound is complete; comply with ASTM C840.
- C. Immediately remove from site gypsum board for interior use exposed to water, including gypsum board with water stains, with signs of mold, and gypsum board with mildew.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. National Gypsum Co.
- B. Georgia-Pacific Corp.
- C. United States Gypsum Co., USG Corp.
- D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide gypsum board assemblies including gypsum board, joint treatment, acoustical accessories, and general accessories.
 - 1. Systems Responsibility: Provide products manufactured by or recommended by manufacturer of gypsum board to maintain single-source responsibility for system.
- B. Performance Requirements: Perform gypsum board systems work in accordance with recommendations of ASTM C840 unless otherwise specified.
- C. Regulatory Requirements, Fire-Ratings: Provide systems listed in applicable code or by Underwriter's Laboratory, Gypsum Association (GA) File No's in GA-600 Fire Resistance Design Manual or other listing approved by applicable authorities.
- D. Gypsum Board: Comply with ASTM C840; maximum permissible lengths; ends square cut, tapered edges on boards to be finished.
 - 1. Typical: ASTM C1396, Type X, fire rated gypsum board, unless otherwise indicated.
 - 2. First Layer at Double Layer Applications: ASTM C1396 or ASTM C442, Type X, fire rated gypsum backing board.
 - 3. Mold Resistant Gypsum Board: Provide at high humidity areas not covered with tile including but not limited to kitchens, bathrooms, showers, laundries, and basements.
 - a. USG Industries/Sheetrock Mold Tough Firecode Core.

- b. Georgia Pacific/ToughRock Mold-Guard Fireguard X.
 - c. National Gypsum Gold Bond XP Fire-Shield Gypsum Board.
 - d. Substitutions: Refer to Section 01 25 00.
- 4. Tile Substrates: Cementitious backer units specified in Section 09 30 00 - Tiling.
- 5. Cementitious Backer Units for FRP and Shower/Tub Surrounds: ANSI A118.9 aggregated Portland cement with woven glass-fiber mesh on both faces; approximately 1/2" thick; UL fire rated as required for fire rated assemblies.
 - a. Manufacturers:
 - 1) National Gypsum Co./PermaBase Cement Board.
 - 2) USG Industries, Durabond Division/Durock.
 - 3) Custom Building Products/Wonderboard.
 - 4) James Hardie Building Products/Hardibacker.
 - 5) Substitutions: Refer to Section 01 25 00.
 - b. Contractor Option Coated Glass Mat Backer Units: Georgia Pacific/DenShield, UL fire rated as required to maintain integrity of fire rated assemblies.
- 6. Standard Gypsum Sheathing: ASTM C1396, Type X, asphalt impregnated core with water resistant surfaces; plain back; square ends, V-tongue and groove long edges.
- 7. Sheathing: Silicone treated glass mat gypsum sheathing, ASTM C1177, Type X, 5/8" thick unless otherwise indicated. Coordinate with exterior insulation system manufacturer requirements.
 - a. Manufacturers:
 - 1) Georgia Pacific/DensGlass Gold.
 - 2) Substitutions: Refer to Section 01 25 00.
- 8. Extended Exposure Gypsum Board: Fire rated Type X gypsum board designed specifically for extended exposure to moisture during construction; ASTM C1177; provide with score of 10 when tested using ASTM D3273 for mold resistance.
 - a. National Gypsum/eXP Extended Exposure Sheathing.
 - b. Georgia Pacific/DensArmor Plus or DensGlass.
 - c. USG/Sheetrock Fiberock Aqua Tough Sheathing.
 - d. Substitutions: Refer to Section 01 25 00.
- 9. Fiberglass Mat Faced Gypsum Roof Board: coordinate with requirements of roofing membrane manufacturer.
 - a. USG Securock Glass-Mat Roof Board.
 - b. Georgia-Pacific DensDeck Prime Roof Board.
 - c. Substitutions: Refer to Section 01 25 00.
- E. Gypsum Board Accessories: Comply with ASTM C840.

1. Provide protective coated steel corner beads and edge trim; type designed to be concealed in finished construction by tape and joint compound.
 2. Corner Beads: Manufacturer's standard metal beads.
 3. Edge Trim: "J", "L", "LK", or "LC" casing beads.
 4. Reinforcing Tape, Joint Compound, Adhesive, Water, Fasteners: Types recommended by system manufacturer and conforming to ASTM C475.
 - a. Typical Joint Compound: Chemical hardening type for bedding and filling, ready-mixed or powder vinyl type for topping.
 5. Control Joints: Back to back casing beads.
 - a. Back control joints with 4 mil thick polyethylene air seal.
 6. Reveals: Extruded aluminum special trim pieces in manufacturer's standard or custom shapes to conform to configurations and dimensions indicated.
 - a. Manufactures:
 - 1) Fry Reglet Corp./Drywall Moldings.
 - 2) Gordon Inc./Final Forms I Drywall Trims.
 - 3) Substitutions: Refer to Section 01 25 00.
- F. Acoustical Accessories: Provide as indicated and as required to achieve acoustical ratings indicated.
1. Resilient Channels: Provide resilient channels where indicated and where required to provide required sound transmission classifications.
 - a. USG/RC-1.
 - b. ClarkDietrich/RC-Deluxe.
 - c. Substitutions: Refer to Section 01 25 00.
 2. Acoustical Insulation: Preformed mineral fiber, ASTM C665, Type I; friction fit type without integral vapor barrier; as required to meet STC ratings indicated, or of thickness indicated.
 3. Acoustical Sealant: ASTM C919, type recommended for use in conjunction with gypsum board. Paintable, non-shrinking and non-cracking where exposed, nondrying, nonskinning, nonstaining, and nonbleeding where concealed.
 - a. Acoustical Sealant Manufacturers:
 - 1) USG/Sheetrock Acoustical Sealant.
 - 2) Tremco/Acoustical Sealant.
 - 3) Pecora/AC-20.
 - 4) Substitutions: Refer to Division 1.

4. Electrical Box Pads: Provide at outlet, switch and telephone boxes in walls with acoustical insulation.
 - a. Electrical Box Pad Manufacturers for Non-Fire Rated Partitions:
 - 1) Harry A. Lowry & Associates (800.772.2521)/Lowry's Electrical Box Pads.
 - 2) Tremco Sheet Caulking (650.572.1656).
 - 3) Fire rated partition material manufacturers.
 - 4) Substitutions: Refer to Section 01 25 00.
 - b. Electrical Box Pad Manufacturers for Fire Rated Partitions:
 - 1) Hevi-Duty Nelson (800.331.7325)/Fire Rated FSP Firestop Putty Pads.
 - 2) Specified Technologies, Inc. (800.992.1180)/Fire Putty Pads.
 - 3) Hilti, Corp./Hilti Box Pads.
 - 4) Substitutions: Refer to Section 01 25 00.
- G. Fire Rated Assembly Accessories: Provide materials and accessories as required to comply with fire rating requirements of UL, GA or other listing approved by applicable authorities.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Gypsum Board Installation: Install in accordance with ASTM C840 and manufacturer's recommendations.
 1. Use screws when fastening gypsum board to furring and to framing.
 2. Erect gypsum board with ends and edges occurring over firm bearing.
 - a. Ensure joints of second layer do not occur over joints of first layer in double layer applications.
 3. For fire rated systems comply with requirements for fire ratings.
 4. Place control joints to be consistent with lines of building spaces and as directed by Architect.
 - a. Provide where system abuts structural elements.
 - b. Provide at dissimilar materials.
 - c. Lengths exceeding 30'-0" in partitions.
 - d. Ceiling areas exceeding 50'-0" or 2500 square feet.
 - e. Wings of "L", "U" and "T" shaped ceilings.
 5. Place corner beads at external corners; use longest practical lengths.
 6. Place edge trim where gypsum board abuts dissimilar materials.
 7. Tape, fill, and sand exposed joints, edges, corners and openings to produce surface ready to receive finishes; feather coats onto adjoining surfaces.

8. Finishing: Comply with Gypsum Association (GA) "Levels of Gypsum Board Finish".
 - a. GA Level 4 (Typical): Provide three-coat finishing and sanding is required for surfaces indicated to be painted; provide flush, smooth joints and surfaces ready for applied paint finishes.
9. Remove and replace defective work.

B. Acoustical Accessories Installation:

1. Place acoustical insulation tight within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
2. Place acoustical sealant within partitions in accordance with manufacturer's recommendations; install acoustical sealant at gypsum board perimeter at:
 - a. Metal Framing: One or two beads.
 - b. Base layer and face layer.
 - c. Penetrations of partitions.
3. Tolerance: Maximum 1/4" space between gypsum board at floor, ceiling, and penetrations and sealed with acoustical sealant.
4. Install electrical box pads with pads molded and pressed on back and all sides of box, closing openings, in accordance with manufacturer's instructions, for complete acoustical barrier.

END OF SECTION

SECTION 09 30 00

TILING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide tile installations with accessories, as required for complete installation.
 - 1. Provide waterproofing membrane integral with tile setting beds.
 - 2. Provide cementitious backer unit tile substrate.
- B. Related Sections:
 - 1. Section 09 21 00: Metal framing and gypsum board.
 - 2. Section 09 30 90: Exterior large format tiling.

1.2 REFERENCES

- A. ANSI A108.1: Installation of Tile with Portland Cement Mortar.
- B. ANSI A108.5: Installation of Tile with Latex-Portland Cement Mortar.
- C. ANSI A108.6: Installation of Tile with Chemical Resistant Water Cleanable Tile Setting and Grouting Epoxy.
- D. ANSI A108.10: Installation of Grout in Tilework.
- E. ANSI A108.11: Interior Installation of Cementitious Backer Units.
- F. Tile Council of North America (TCNA): Handbook for Ceramic Tile Installation.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination, Large Format Tile and Framing: Tile Council of North America (TCNA) requires framing at large format tile to be maximum 16" on center and for maximum deflection of $L/720$ where large format tile as defined by TCNA is indicated.
 - 1. Coordinate with framing installation to ensure proper stud spacing and deflection limits are provided at locations where large format tile is indicated.

1.4 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature for each type of material for Project.
- B. Samples: Furnish each type of tile clearly indicating pattern, coloration and joints.
 - 1. Color Charts: Submit actual tile sections showing full range of colors, textures and patterns available for each type of tile.

2. Prepare two 12" square sample panels of each selected type of tile and grout.

1.5 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives, sealants, and caulks.

1.6 SITE CONDITIONS

- A. Provide heat and ventilation in areas where ceramic tile work is being performed, to allow tile to properly set.
- B. Take precautionary measures necessary to ensure excessive temperature changes do not occur.

1.7 WARRANTY

- A. Extended Correction Period: Provide for correcting failure of system to resist water penetration except where failure is result of structural failure of building. Repair system and pay for or replace damaged materials and surfaces.

1. Hairline cracking due to temperature or shrinkage is not considered structural failure.

2. Period: Two years.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Description: Provide tile installations with tile, grout, setting materials, and accessories as indicated.

- B. Regulatory Requirements, General:

1. Interior Adhered Veneer: Comply with applicable California Code requirements for interior adhered veneer; maximum 20-psf.
2. Exterior Adhered Porcelain Veneer: Comply with applicable California Code requirements for exterior adhered veneer; maximum 9-psf, 5/8" thick, 24" in any face dimension, nor more than 3-sf in total face area.

- C. Regulatory Requirements, Slip-Resistance:

1. Slip-Resistant Hard Surfaces: Hard surface finishes to comply with requirements of authorities having jurisdiction for slip-resistant hard surfaces, including general code requirements and requirements for access for persons with disabilities.

- D. Tile: Types as indicated which could include ceramic, ceramic mosaic, quarry, paver, porcelain, stone, and glass type tiles.
 - 1. Manufacturers:
 - a. Dal-Tile Corp.
 - b. Crossville Tile.
 - c. Summitville Tiles, Inc.
 - d. Manufacturers listed on Finish Schedule. **(Basis of Design)**
 - e. Substitutions: Refer to Section 01 25 00.
 - 2. Color, Style and Pattern: As indicated on Finish Schedule, as selected by Architect from manufacturer's full range of types of tiles indicated where not otherwise indicated
 - a. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
 - 3. Base and Trim: Provide matching trim pieces, coordinated with sizes and coursing of adjoining flat tile as directed by Architect; types as indicated, as selected by Architect where not indicated.
- E. Portland Cement Setting Bed: Portland cement bed conforming to ANSI A108.1 and TCNA recommendations including separator sheet and reinforcing mesh.
 - 1. Separator sheet may be deleted where over waterproof membrane.
 - 2. Separator sheet may be deleted where over waterproof membrane or shower pan.
- F. Latex Thin Set: Thinset bond coat, consisting of latex-cementitious mortar conforming to ANSI A118.4.
 - 1. Manufacturers:
 - a. Laticrete International Inc.
 - b. Bostik Construction Products/Hydroment.
 - c. Custom Building Products.
 - d. Mapei Corp.
 - e. Parex USA/Mer-Krete.
 - f. Substitutions: Refer to Section 01 25 00.
- G. Latex-Cement Grout: ANSI A118.7, latex-cementitious type, uniform in color, resistant to shrinkage.
 - 1. Manufacturers:
 - a. Laticrete International Inc.
 - b. Bostik Construction Products/Hydroment.
 - c. Custom Building Products.
 - d. Mapei Corp.
 - e. Parex USA/Mer-Krete.
 - f. Substitutions: Refer to Section 01 25 00.

2. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- H. Waterproofing and Crack Isolation Membrane: Manufacturer's standard liquid rubber polymer designed specifically for application under tile in non-immersed applications.
 1. Manufacturers:
 - a. Laticrete International Inc./9235 Waterproof Membrane.
 - b. Bostik Construction Products/Hydroment Ultra-Set.
 - c. Custom Building Products/RedGard Membrane.
 - d. Mapei Corp/Mapelastic Aqua Defense.
 - e. Parex USA/Mer-Krete Hydro-Guard 2000.
 - f. Substitutions: Refer to Section 01 25 00.
- I. Cementitious Backer Units: ANSI A118.9 aggregated Portland cement with woven glass-fiber mesh on both faces; approximately 1/2" thick; UL fire rated as required to maintain integrity of fire rated assemblies.
 1. Manufacturers:
 - a. USG Industries, Durabond Division/Durock.
 - b. National Gypsum Co./PermaBase Cement Board.
 - c. Custom Building Products/Wonderboard.
 - d. Substitutions: Refer to Section 01 25 00.
 2. Contractor Option Coated Glass Mat Backer Units: Georgia Pacific/DenShield, UL fire rated as required to maintain integrity of fire rated assemblies.
- J. Cleaning and Sealing Materials: As recommended by tile and grout manufacturers, such as Bostik Construction Products/Hydroment CeramaSeal.
- A. Special Tile Trim Pieces: Provide as indicated on Drawings.
 1. Manufacturers:
 - a. Schluter Systems L.P.
 - b. Substitutions: Refer to Section 01 25 00.

2.2 MIXES

- A. Mix and proportion cementitious materials for site-made leveling coats, setting beds and grout as recommended by the TCNA Handbook for Ceramic Tile Installation.
- B. Mix and proportion pre-mixed setting beds and grout materials in accordance with manufacturer's recommendations.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prior to installing tile, ensure surfaces are level; comply with TCNA and tile manufacturer recommendations but not greater than following.
 - 1. Bed Set Tile Tolerance: Maximum surface variation of 1/4" in 10'-0".
 - 2. Thin Set Tile Tolerance: Maximum surface variation of 1/8" in 10'-0".
- B. Ensure surfaces are clean and well cured.
 - 1. Drains: Where indicated, ensure surfaces are properly sloped to drains.
- C. Do not commence work until surface conditions are within tolerances required for proper installation; apply latex leveling material where necessary to meet required tolerances.
- D. Waterproof and Crack Isolation Membrane: Install waterproof membrane at tile areas located above grade, in accordance with manufacturer's recommendations; extend membrane minimum 6" up walls.
 - 1. Comply with waterproof membrane manufacturer recommendations for installation of tile over waterproof membrane.
- E. Acoustic (Sound Deadening) Underlayment: Install acoustic underlayment system
- F. Backer Units: Install units in accordance with ANSI A108.11, manufacturer's recommendations, and as required to provide fire ratings indicated on Drawings.
- G. Floor Sealer: Apply vapor retarding floor sealer on concrete floors indicated to receive epoxy set tile in accordance with manufacturer recommendations and installation instructions.

3.2 INSTALLATION

- A. Install tile in accordance with referenced ANSI Standards and TCNA recommendations for type of substrate and indicated setting method.
 - 1. Complexity of TCNA variations in types of tile installation systems and potential for changes to surrounding conditions during design and construction makes exact listing of potential conditions improbable.
 - 2. Contractor, installers, and manufacturer representatives shall inform Architect where actual conditions are not covered and where providing similar materials and systems do not comply with TCNA or manufacturer recommendations.
 - a. Where specified or similar materials and systems do not comply with TCNA or manufacturer recommendations submit proposed substitutions along with statement substitutions are of comparable quality to specified materials.

- B. Following systems shall form the basis of tile installation systems required for Project. Where Project conditions vary from TCNA and manufacturer recommendations, notify Architect immediately. Where different use similar materials and systems as appropriate.
 - 1. Bed Set Floors over Concrete: TCNA F111, with latex cement bond coat.
 - 2. Bed Set Floors over Wood: TCNA F141, with latex cement bond coat.
 - 3. Bed Set Floors over Waterproof and Crack Isolation Membrane over Concrete: TCNA F121, with latex cement bond coat.
 - 4. Bed Set Floors over Waterproof and Crack Isolation Membrane over Wood: TCNA F141, with latex cement bond coat.
 - 5. Latex-Cement Thin Set Floors over Concrete: TCNA F113.
 - 6. Latex-Cement Thin Set Floors over Waterproof and Crack Isolation Membrane: TCNA F122.
 - 7. Latex-Cement Thin Set Floors over Acoustic Underlayment: TCNA F122.
 - 8. Latex-Cement Thin Set Floors over Cementitious Backer Unit over Wood: TCNA F144.
 - 9. Latex-Cement Thin Set Wall Tile over Cementitious Backer Units: TCNA W244.
 - 10. Latex-Cement Thin Set Wall Tile over Coated Glass Mat Backer Units: TCNA W245.
- C. Place tile in accordance with patterns indicated on Drawings or as directed by Architect; carefully plan tile layouts, ensure pattern is uninterrupted from one surface to the next and through doorways.
 - 1. Apply latex thin set to back of tile where necessary to ensure 100% bond between bond coat and substrate; replace tiles which break due to voids between tile and substrate.
- D. Place stone thresholds level and true to line; in correct alignment with tile, doors and partitions.
- E. Neatly cut tile around fixtures and drains; accurately form corners, base, intersections and returns.
 - 1. Base, Coves: Flush cove type with base grout joint on wall, cove tile on floor, unless otherwise indicated.
 - 2. Corners and Edges: Bullnose tile unless otherwise indicated.
- F. Locate expansion joints, control joints, contraction joints, and isolation joints where indicated; where not indicated, provide as recommended by TCNA Handbook and as approved by Architect.

1. Install special trim pieces as indicated on Drawings and in accordance with manufacturer recommendations and installation instructions, true to lines and levels indicated and in correct relationship with tile and adjacent materials.
- G. Ensure tile joints are uniform in width, subject to normal variance in tolerance allowed in tile size; ensure joints are watertight, without voids, cracks, excess mortar or grout.
- H. Sound tile after setting, remove and replace hollow sounding units.
- I. Allow tile to set for a minimum 48 hours prior to grouting.
- J. Grout tile to comply with recommendations of TCNA and as specified.
- K. Leave completed installation free of broken, damaged and faulty tile.

3.2 CLEANING AND SEALING

- A. Clean tile surfaces free of foreign matter upon completion of grouting.
- B. Seal tile and grout surfaces where recommended by manufacturer for materials and applications involved; comply with manufacturer's recommendations.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide suspended acoustical ceiling system with exposed suspended metal grid system, trim, and accessories as required for complete finished installation.
- B. Related Sections:
 - 1. Divisions 21 through 28: Facilities services for ceiling penetrations.

1.2 REFERENCES

- A. ASTM C423 Test method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
- B. ASTM C635: Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- C. ASTM C636: Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- D. ASTM E84 Practices for Surface Burning Characteristics.
- E. ASTM E580: Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Seismic Restraint.
- F. ASTM E795 Practices for Mounting Test Specimens during Sound Absorption Tests.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate installation of acoustical ceiling systems with items installed above ceilings to ensure work above ceilings is complete, ceiling space allows for concealed items while allowing required ceiling heights, and building is enclosed.

1.4 SUBMITTALS

- A. Product Data: Furnish manufacturers' literature, including the acoustical performance.
- B. Shop Drawings: Clearly indicate grid layout and related dimensioning, junctions with other work and ceiling finishes, and inter-relation of mechanical and electrical items related to system.
- C. Samples: Furnish (3) samples of tile panel.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Firm with minimum five years successful experience in projects of similar type and scope; acceptable to manufacturer of integrated acoustical ceiling system.

1.6 SITE CONDITIONS

- A. Do not install ceilings until building is enclosed, sufficient heat is provided, dust generating activities have terminated and overhead mechanical work is completed, tested and approved.
 - 1. Do not allow acoustical ceiling units to be exposed to moisture; immediately remove acoustical ceiling units with stains, units with signs of mold, and units with mildew.
- B. Allow wet work to dry prior to commencement of installation.
- C. Maintain uniform temperatures of minimum 60 degrees F and humidity of 20% to 40% prior to, during and after installation.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Armstrong World Industries, Inc.
- B. CertainTeed.
- C. Rockfon North America, Chicago Metallic Corp.
- D. USG Corporation.
- E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide acoustical ceiling systems with exposed suspended metal grid system, trim, and accessories as required for complete finished installation.
- B. Regulatory Requirements:
 - 1. Seismic Design Requirements: Comply with California Building Code requirements for seismic bracing of ceiling suspension system, and with ASTM E580.
 - a. Ceiling Struts: Provide struts as detailed on Drawings and as required by code, placed maximum 12'-0" on center in both directions and within 6'-0" of each wall.
 - b. Slack Wires: Provide safety slack wires, two per fluorescent fixture on diagonally opposite corners and a single wire for each recessed down light.

2. Fire Performance Characteristics: Provide products listed by Underwriters Laboratories (UL) or other independent testing laboratory acceptable to applicable authorities.
 - a. Flame Spread/Smoke Density: Provide products meeting code requirements for maximum 25 flame spread and maximum 450 smoke developed.
- C. Suspension Systems: Comply with ASTM C635, as applicable to type of suspension system required for type of ceiling units indicated.
 1. Grid System:
 - a. Exposed Grid System: Narrow 9/16" nominal face width, direct hung, aluminum or steel "T" exposed grid system.
 2. Attachment Devices: Size for 5 times design load indicated in ASTM C635, Table 1, Direct Hung.
 3. Hanger Wires: Galvanized carbon steel, ASTM A641, soft temper, pre-stretched, yield-stress load of at least three times design load, but not less than 12-gage.
 4. Straps, Tubes and Angles: Provide galvanized steel as required to meet state and local requirements for seismic design loads.
 5. Structural Class: Minimum intermediate-duty system.
 6. Edge Molding: Manufacturer's standard angle molding for edges and penetrations of ceiling, with single flange of molding exposed.
 7. Finish of Exposed Items: Manufacturer's standard white baked enamel.
 8. Maximum Allowable Deflection: L/360.
- D. Acoustical Panels:
 1. Panels: **basis of design: Armstrong CALLA, 1" thick, square tegular 9/16, .85 NRC. Color: white. ASTM E1264, E84.**
 2. Size: 2'-0" by 2'-0", except where otherwise indicated on Drawings.
 3. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Furnish layouts for inserts, clips and other supports required to be installed by other trades for support of acoustical ceilings.
 1. Install inserts, clips, and supports where not previously installed and where additional supports are required for complete installation.

- B. Measure ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling; do not use less than half width units at borders.
- C. Coordinate with other work supported by or penetrating through ceilings, including integral air handling systems, light fixtures, and other systems.

3.2 INSTALLATION

- A. Install acoustical ceiling systems in accordance with manufacturer's recommendations and ASTM C636.
 - 1. Coordinate installation of air handling systems and electrical systems integral with integrated acoustic ceiling systems.
 - 2. Finished Ceilings: True to lines and levels and free from warped, soiled or damaged grid or acoustical units.
- B. Install ceiling systems in a manner capable of supporting superimposed loads, with maximum permissible deflection of 1/8" in 10'-0".
- C. Install after major above-ceiling work is complete; coordinate location of hangers with other work.
 - 1. Ensure suspension system is located to accommodate fittings and units of equipment which is to be placed after installation of ceiling grid.
- D. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest adjacent hangers and related carrying channels as required to span required distance.
- E. Install ceiling suspension system to resist seismic loads as required by state and local codes, including extra hanger wires and compression supports for ceilings and light fixtures.
- F. Hang system independently of walls, columns, ducts, pipes and conduit. Where suspension system members are spliced, avoid visible displacement of the longitudinal axis or face plane of adjacent members.
- G. Do not support lighting fixtures from or on main runners or cross runners if weight of fixture causes total dead load to exceed deflection capability.
 - 1. Support fixture loads independently or provide supplementary hangers located within 6" of each corner.
- H. Do not install fixtures so main runners and cross runners are eccentrically loaded; where fixture installation would produce rotation of runners, provide stabilizer bars.
- I. Install edge moldings at intersection of ceiling and vertical surfaces, using maximum lengths, straight, true to line and level; miter corners.
 - 1. Provide edge moldings at junctions with other ceiling finishes.
- J. Where required form expansion joints to accommodate movement and maintain visual closure without distorting system.

- K. Fit acoustic units in place, free from damaged edges or defects detrimental to appearance and function.
 - 1. Lay directionally patterned units one way with pattern as directed.
 - 2. Fit border units neatly against abutting surfaces.
- L. Install system level, in uniform plane and free from twist, warp and dents.
- M. Install hold-down clips where required by applicable codes and where ceiling is within 20'-0" of an exterior door.

3.3 ADJUSTING

- A. Adjustment: Adjust sags or twists which develop in ceiling system and replace any part which is damaged or faulty.

END OF SECTION

SECTION 09 65 10

RESILIENT BASE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide resilient base and accessories as required for complete finished installation.
- B. Related Sections:
 - 1. Section 09 68 10: Carpet tile edge strips.

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's product literature.
- B. Samples: Furnish samples of each base color and type.

1.3 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives and resilient flooring.

1.4 SITE CONDITIONS

- A. Comply with manufacturer recommendations for site conditions but not less than following; maintain minimum 70-degree F air temperature at installation area for three days prior to, during, and for 24 hours after installation.
- B. Store materials in area of application; allow three days for material to reach same temperature as area.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Johnsonite, Inc.
- B. Burke Flooring, Division of Burke Industries.
- C. Roppe Rubber Corporation.
- D. Armstrong World Industries.
- E. Flexco Co.
- F. Allstate Rubber Corp.
- G. Manufacturers listed on Finish Schedule.

- H. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide resilient base and accessories as required for complete finished installation.
- B. Performance Requirements: Provide materials tested under ASTM E648, Flooring Radiant Panel Test, with results of 0.45 watts/sq. cm or higher.
- C. Resilient Base: Conform to ASTM F1861, with premolded end stops and external corners; 1/8" gage; provide coved base at hard floor surfaces, straight base at carpet unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Apply to walls, columns, pilasters, casework, and other permanent fixtures in rooms and areas where base is required.
 - 1. Fit base joints tight and vertical.
 - 2. Maintain minimum measurement of 18" between joints.
- B. Miter internal corners; use molded sections for external corners and exposed ends.
- C. Install base on solid backing, adhere tightly to wall and floor surfaces; fill voids along top edge of base with manufacturer's recommended adhesive filler.
- D. Scribe and fit to door frames and other obstructions.
- E. Install straight and level to variation of plus or minus 1/8" over 10'-0".

3.2 CLEAN-UP

- A. Remove excess adhesive from floor, base and wall surfaces without causing damage.
- B. Clean surfaces in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 09 65 20
RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide resilient tile flooring and accessories as required for complete finished installation.
- B. Related Sections:
 - 1. Section 09 65 10: Resilient base.
 - 2. Section 09 68 10: Carpet tile edge strips.

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's product literature.
- B. Samples: Furnish samples of each type of flooring color and pattern.

1.3 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives and resilient flooring.

1.4 SITE CONDITIONS

- A. Ensure floor surfaces are smooth and flat with maximum variation of 1/8" in 10'-0".
- B. Ensure concrete floors are dry and exhibit negative alkalinity, carbonizing, and dusting.
- C. Maintain minimum 70-degree F air temperature at flooring installation area for three days prior to, during, and for 24 hours after installation.
- D. Store flooring materials in area of application; allow three days for material to reach same temperature as area.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Armstrong World Industries, Inc. **(Basis of Design)**
- B. Congoleum Corp.
- C. Tarkett Inc/Azrock.
- D. Flexco Flooring.

- E. Burke Mercer.
- F. Johnsonite, Inc.
- G. Freudenberg Building Systems, Inc. (NORA).
- H. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide resilient tile flooring and accessories.
- B. Regulatory Requirements, Flammability: Provide materials tested under ASTM E648, Flooring Radiant Panel Test, with results of 0.45 watts/sq cm or higher.
- C. Regulatory Requirements, Slip-Resistance:
 - 1. Slip-Resistant Hard Surfaces: Hard surface finishes to comply with requirements of authorities having jurisdiction for slip-resistant hard surfaces, including general code requirements and requirements for access for persons with disabilities.
- D. Vinyl Composition Tile (VCT): 12" by 12" by 1/8" thick; vinyl composition tile conforming to ASTM F1066, Composition 1.
 - 1. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- E. Edge Strips: Homogeneous vinyl or rubber, tapered or bullnose edge, color as selected by Architect.
- F. Sub-Floor Filler: White premixed latex-cement paste designed for providing thin solid surface for leveling and minor ramping of subsurface to adjacent floor finishes.
 - 1. Use material capable of being applied and feathered out to adjacent floor without spalling.
- G. Primers and Adhesives: Waterproof nontoxic types as recommended by flooring manufacturer for specified material and application.
- H. Sealer and Wax: Type recommended by flooring manufacturer for material type and location.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Conform to manufacturer's recommendations for preparation and to ASTM F710.
- B. Remove sub-floor ridges and bumps; fill low spots, cracks, joints, holes and defects with sub-floor filler.
- C. Clean floor and apply, trowel and float filler to leave smooth, flat hard surface; prohibit traffic until filler is cured.

- D. Test substrate for moisture content in accordance with flooring manufacturer recommendations; where moisture content exceeds recommendations take measures recommended by flooring manufacturer.

3.2 INSTALLATION

- A. Conform to manufacturer recommendations and installation instructions.
 - 1. Open floor tile cartons, enough to cover each area, and mix tile to ensure shade variations do not occur within any one area.
- B. Spread cement evenly in quantity recommended by manufacturer to ensure adhesion over entire area of installation; spread only enough adhesive to permit installation of flooring before initial set.
- C. Set flooring in place using methods to ensure full adhesion.
- D. Lay flooring with joints parallel to building lines to produce symmetrical pattern.
- E. Install minimum 1/2 tile at room and area perimeter.
- F. Terminate resilient flooring at centerline of door openings where adjacent floor finish is dissimilar.
- G. Install edge strips at unprotected and exposed edges.
- H. Scribe flooring to walls, columns, floor outlets and other appurtenances, to produce tight joints.
- I. Consult with Architect for floor pattern desired in each area.
- J. Edge Strips: Install where edge of tile would otherwise be exposed; butt to flooring without gaps; set in adhesive.

3.3 CLEAN-UP AND PROTECTION

- A. Remove excess adhesive from floor, base and wall surfaces without causing damage.
- B. Clean, seal and wax floor surfaces in accordance with manufacturer's recommendations.
- C. Prohibit traffic from floor for 48 hours after installation.

END OF SECTION

SECTION 09 68 10

TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide carpet tile including edge strips where carpeting terminates at other floor finishes and accessories as required for complete finished installation.
- B. Related Sections:
 - 1. Section 09 65 10 Resilient Base
- C. SUBMITTALS
- D. Product Data: Prior to final acceptance of carpet tile installation, submit manufacturer's detailed maintenance recommendations for care, cleaning and repair of carpet tiles installed.
- E. Shop Drawings: Clearly indicate carpet tile layout, direction of carpet tiles, adhesive to be used, method of integrating edge strips with carpet tile, and installation procedures.
- F. Samples: Submit samples of each carpet tile type and color, and of each color of edge strip.
- G. Certificate of Compliance: Furnish manufacturer's certificate of compliance stating each material delivered conforms to Specifications.
- H. Maintenance Recommendations: Prior to final acceptance of carpet tile installation, furnish carpet tile manufacturer's detailed maintenance recommendations for care, cleaning and repair of carpet tiles installed.
- I. Maintenance Materials: Submit unused carpet tiles. Box unused carpet tiles and mark boxes indicating color and location installed.

1.2 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for carpet systems and adhesives.
- B. Installer Qualifications: Firm with minimum five years successful experience in carpet tile installation and approved by carpet tile manufacturer.
 - 1. Upon request, submit letter from carpet manufacturer stating installer is acceptable.

1.3 PROJECT CONDITIONS

- A. Do not commence carpet tile installation until painting and finishing work is complete and ceiling and other overhead work has been tested, approved and completed, unless specifically approved.
- B. Maintain room temperature at minimum 60 degrees F for at least 24 hours prior to installation; relative humidity shall be approximately that at which area is to be maintained.
- C. Schedule, receive, and place carpet tile on floors indicated; protect from soiling and damage during transit, storage, and installation.

1.4 WARRANTY

- A. Extended Correction Period: Provide for promptly making good or replacing defective materials or workmanship. Repairs shall take place within ten days of written notification.
 - 1. Period: Two years.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Collins and Aikman Corp.
- B. Bentley Prince Street.
- C. Interface Flooring Systems, Inc.
- D. Lees Carpets, Division of Burlington, Inc.
- E. Shaw Commercial Carpets.
- F. Manufacturers listed on Finish Schedule. **(Basis of Design)**
- G. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide carpet tile including edge strips where carpeting terminates at other floor finishes and accessories.
- B. Regulatory Requirements: Carpet tiles shall have passed following fire and smoke tests.
 - 1. DOC-FF-1-70: Pass.
 - 2. ASTM E662 (Smoke Developed): 450 or less.
 - 3. ASTM E648 or NFPA 253 (Flooring Radiant Panel Test): 0.45 or higher.
- C. Design Criteria: Provide carpet materials that bear Carpet and Rug Institute "Green Label Plus".

- D. Performance Requirements, Static: Carpet tile shall develop less than 3.0 kilovolts of static at 70 degrees F and 20 percent relative humidity.
- E. Carpet Tile: Types as indicated on Finish Schedule; where carpet tile is not indicated provide as directed by Architect based on following criteria.
 - 1. Yarn: 6.6 or later generation continuous filament soil hiding nylon.
 - 2. Face Weight: Minimum 30 oz. per square yard.
 - 3. Tile Size: As indicated, as selected by Architect from manufacturer's full range of carpet tile sizes where not indicated.
 - 4. Pile Height: Maximum 1/2".
 - 5. Backing: Integrated polyurethane cushion; no latex backing permitted.
 - 6. Antimicrobial Treatment: Provide to inhibit growth of bacteria, mold, and mildew.
 - 7. Soil-Resistant Treatment: Manufacturer's standard integral stain resistance.
 - 8. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- F. Adhesive: Nontoxic type recommended by carpet tile manufacturer to suit application and expected service.
- G. Leveling and Ramping Material: Latex-cement material designed for providing thin solid surface for leveling and minor ramping of subsurface to adjacent floor finishes.
 - 1. Use material capable of being applied and feathered out to adjacent floor without spalling.
- H. Edge Strips: Vinyl or rubber.
 - 1. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- I. Accessories: Provide as required for complete finished installation.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean floors of dust, dirt, solvents, oil, grease, paint, plaster and other substances detrimental to proper performance of adhesive and carpet tile; allow floors to thoroughly dry.
- B. Ensure floors are level, with maximum surface variation of 1/4" in 10 feet.
- C. Ensure concrete floors are free from scaling and irregularities and exhibit neutrality relative to acidity and alkalinity.

- D. Use leveling and ramping material to patch cracks, small holes, leveling and for ramping to provide finished carpet tile within 1/2" of adjacent flooring materials.
- E. Test substrate for moisture content in accordance with flooring manufacturer recommendations; where moisture content exceeds recommendations take measures recommended by flooring manufacturer.

3.2 INSTALLATION

- A. Install carpet tiles in accordance with manufacturer's recommendations and installation instructions.
 - 1. Adhere tiles to subfloor unless otherwise approved.
- B. Prime substrate if required and as recommended by manufacturer. Spread adhesive in quantity recommended by manufacturer to ensure proper adhesion. Apply only enough adhesive to permit proper adhesion of carpet tile before initial set.
- C. Lay carpet tile with run of pile in direction of anticipated traffic; do not change run of pile in any one room or from one room to next where continuous through a wall opening.
 - 1. Finished installation to provide monolithic carpet tile appearance as approved by Architect.
- D. Cut and fit carpet tile neatly around projections through floor and to walls and other vertical surfaces.
- E. Fit carpet tiles snugly to walls or other vertical surfaces, leaving no gaps.
- F. Lay installation tight and flat to subfloor well fastened and uniform in appearance; ensure monolithic color, pattern and texture match within any one area.
- G. Edging Strips: Install in accordance with manufacturer recommendations and installation instructions.
 - 1. Install edging strips where carpet terminates at other floor coverings.
 - 2. Use full length pieces only, butt tight to vertical surfaces. Where splicing cannot be avoided, butt ends tight and flush.
- H. Do not place heavy objects such as furniture on carpet tiled surfaces for not less than 24 hours or until adhesive is set.

3.3 CLEANING

- A. Upon completion of carpet tile installation in each area, visually inspect carpet tile installed in that area and immediately remove dirt, soil and foreign substance from exposed face.
- B. Clean in accordance with manufacturer's recommendations.
- C. Inspect adjacent surfaces and remove marks and stains caused by carpet tile installation.

- D. Remove packaging materials, carpet tile scraps, and other debris from carpet tile installation.

END OF SECTION

SECTION 09 77 20

FABRIC WRAPPED PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide fabric wrapped panels including attachment devices and accessories as required for complete finished installation.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Scheduling: Schedule installation of panels as close to Project completion as possible to prevent damage during construction and movement of materials.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's literature including information verifying compliance with performance requirements.
- B. Shop Drawings: Show panel construction and attachment method.
- C. Samples: Furnish each type of fabric.
- D. Maintenance Instructions: Furnish for each fabric.
 - 1. Include recommended cleaning materials and application methods, including precautions for cleaning materials that may be detrimental to surfaces if improperly applied.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store fabric panels in clean and dry area where temperatures are maintained at minimum 40 degrees F with normal humidity.
- B. Maintain surfaces and materials at minimum 60 degrees F for three days before and during application period.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Capaul Corp.
- B. Conwed Designscape | Wall Technology, Inc.
- C. Decoustics Ltd.
- D. Wall Technology, Inc.

- E. LBI/Boyd (800.472.7891).
- F. Manufacturers listed on Finish Schedule.
- G. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide fabric wrapped panels including attachment devices and accessories.
- B. Regulatory Requirements: Flame Spread/Smoke Developed maximum 25/450 when tested in accordance with ASTM E84.
- C. Panels: Manufacturer's standard fabric wrapped panel system.
 - 1. Core: Fiberglass core with chemically hardened edges to resist edge damage; minimum 7 lb/cu. ft. fiberglass core density; wrap fabric at edges to provide trimless edges.
- D. Fabric: As indicated; if not indicated, as selected by Architect from panel manufacturer's full line of fabrics.
- E. Panel Fasteners: Manufacturer's standard concealed metallic fastener system.

2.3 FABRICATION

- A. Secure fabric to panels without wrinkles, gaps, seams or overlaps.
- B. Table square fabrics to provide completed panels with fabric yarns square and plumb.
- C. Bond fabric to panel.
- D. Tailor corners to maintain fabric flat and even.
- E. Completed Panels: Dimensionally stable fabric wrapped panel system.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Ensure wall surfaces to receive panels are clean, true and free of irregularities.
- B. Ensure wall surface flatness tolerance does not vary more than 1/8" in 10'-0", nor vary at a rate greater than 1/16" per running foot.

3.2 APPLICATION

- A. Handle and apply panels in accordance with manufacturer's recommendations and installation instructions.
- B. Attach clip or magnetic system in accordance with panel manufacturer's recommendations and installation instructions. Secure to walls as indicated.

- C. Apply panels level and true.

3.3 CLEANING

- A. Remove debris and leave areas neat and clean.
- B. Replace damaged and defective panels.

END OF SECTION

SECTION 09 77 30

FIBERGLASS WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide glass fiber reinforced polyester resin fabricated wall panels with trim pieces and accessories as required for complete installation.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Scheduling: Schedule installation of wall paneling as late in construction schedule as possible to prevent damage during construction.

1.3 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature.
- B. Maintenance Instructions: Include manufacturer's recommended cleaning materials and application methods, including precautions in use of cleaning materials that may be detrimental to surfaces.

1.4 QUALITY ASSURANCE

- A. CALGreen Sustainability Requirements: Comply with CALGreen requirements including those relative to pollution control for adhesives.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store panels in clean and dry area where temperatures are maintained at minimum 40-degrees F with normal humidity.
 - 1. Do not store in upright position.
- B. Take precautionary measures with adhesives and solvents to prevent fire hazards.

1.6 PROJECT CONDITIONS

- A. Maintain surfaces and materials at minimum 60-degrees F three days before and during application period.
- B. Provide continuous ventilation during work and after installation of wall covering.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Crane Composites/Glasbord.
- B. Nudo Products, Inc./Fiber-Lite Panels or Marlite FRP Panels.

- C. Stabilit America/Glasteel FRP Liner Panel.
- D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide glass fiber reinforced polyester resin fabricated wall panels, with trim pieces and accessories.
- B. Regulatory Requirements:
 - 1. Fire-Rating: Class III (UL Class C), maximum 200 flame-spread, 450 smoke developed, ASTM E84.
 - 2. Wet Wall Applications: Provide system acceptable by applicable authorities for use on walls in toilet rooms including at locations adjacent to water closets and urinals.
- C. Panels: Fiberglass reinforced plastic (FRP) panel system acceptable for use as toilet room wall panels, adjacent to water closets and to urinals; ASTM D5319.
 - 1. Thickness: 0.090" nominal thickness.
 - 2. Antibacterial, Mold, and Mildew: Provide panels with integral antibacterial additive and which are mold and mildew resistant.
 - 3. Color and Texture: white, embossed
- D. Trim Pieces: Manufacturer's standard matching moldings and trim pieces as required for complete, finished installation, and as required for joints, corners and panel edges; suitable for applications indicated.
 - 1. Color: Match panels.
- E. Adhesive: Nontoxic type recommended by wall covering manufacturer to suit application and complying with applicable limitations for volatile organic compound (VOC) emissions.
 - 1. Surface: As selected by Architect from manufacturer's full range of surface textures.
- F. Primer: Provide non-staining nontoxic release coat primer as recommended by wall panel manufacturer where panels are applied to gypsum board.
 - 1. Primer: Type designed to allow removal of wall paneling from gypsum board without damaging paper facing of board, and without premature separation of wall paneling from wall.
- G. Mechanical Fasteners: Concealed type only; types as recommended by system manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Ensure surfaces to receive wall paneling are clean, true and free of irregularities, do not commence with work until surfaces are satisfactory.
- B. Ensure wall surface flatness tolerance does not vary more than 1/8" in 10'-0", nor vary at a rate greater than 1/16" per running foot.

3.2 INSTALLATION

- A. Handle and install wall panels in accordance with manufacturer's recommendations and installation instructions.
- B. Cope and miter trim pieces.
- C. Securely adhere panels to wall surfaces; use blind nailing methods as required to support panels until adhesive dries; exposed mechanical fasteners shall not be acceptable.
 - 1. Install panels in maximum size increments available.
- D. Remove excess adhesive from edges; wipe seam clean with dry cloth towel.
- E. Install wall paneling before installation of plumbing, bases, hardware, and similar accessories.

3.3 CLEANING

- A. Clean panel system in accordance with manufacturer's instructions.
- B. Remove debris and leave areas neat and clean.
- C. Replace accessories.

END OF SECTION

SECTION 09 90 00

PAINTING AND COATING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide painting and finishing of exposed items and surfaces requiring field painting and finishing including shop primed items.
 - 1. Specified surface preparation, priming and coats of paint are in addition to shop-priming and surface treatment specified under other sections of work.
 - 2. Painting and finishing include field finishing of exterior and interior items not listed as "Surfaces not to be Painted" unless clearly indicated otherwise.
 - 3. Painting and finishing include field finishing of select shop finished items such as mechanical grilles and registers and shop primed items such as access panels and louvers in doors, to match adjacent surfaces.
 - a. Match adjacent surfaces in color and sheen unless otherwise indicated.
 - 4. Field paint exposed bare and covered pipes, ducts, and hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under mechanical and electrical work in occupied spaces.
 - 5. Wood Doors: Contractor option to factory finish or field finish, coordinate with Section 08 14 00 - Wood Doors.
- B. Surfaces Not to be Painted:
 - 1. Finished items including finished metal surfaces.
 - 2. Walls and ceilings in concealed areas and generally inaccessible areas.
 - 3. Moving parts of operating mechanical and electrical units.
 - 4. Labels: Keep equipment identification and fire rating labels free of paint.
 - 5. Plastic smoke stops and weather-stripping at doors.
- C. Related Sections: Shop priming of ferrous metal items is included under various Specification sections.
 - 1. Section 06 40 00: Shop finishing of architectural woodwork.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's technical information, including paint label analysis and application instructions for each material.

- B. Samples: Submit samples for review of color and texture; provide list of material and application for each coat of each finish sample.
 - 1. Brush-Outs: Submit samples of each color and material with texture to simulate actual conditions, on hardboard.
 - a. Submit 8" by 10" samples of wood finishes on actual wood surfaces; label and identify each as to location and application.
 - b. Submit samples of concrete masonry (maximum 4" square) defining filler, prime and finish coats.
- C. Manufacturer Certificates: Furnish certificates from each manufacturer stating materials are top quality lines and suitable for intended use on this Project.
 - 1. CALGreen: Submit additional information as necessary to verify compliance with CALGreen requirements.
 - 2. CALGreen Requirements: Refer to Section 01 35 15 – CALGreen Environmental Requirements and comply with applicable CALGreen Checklist indicating requirements applicable to Project.
 - a. Comply with CALGreen requirements including those relative to finish material pollution control for paints and coatings.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label, with:
 - 1. Name of material, color and sheen.
 - 2. Manufacturer's name, stock number and date of manufacture.
 - 3. Contents by volume, for major pigment and vehicle constituents.
 - 4. Thinning and application instructions.

1.4 SITE CONDITIONS

- A. Apply water-base paints when temperature of surfaces and surrounding air are between 50 and 90-degrees F.
- B. Do not apply paint in rain, fog or mist; or when relative humidity exceeds 85 percent; or to damp or wet surfaces.
- C. Painting may be continued during inclement weather if areas to be painted are enclosed and heated within temperature limits specified.
- D. Provide additional temporary ventilation during interior application of paints to eliminate volatile organic compound (VOC) emissions from interior spaces as quickly as possible.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Dunn-Edwards Corp. **(Basis of Design)**
- B. Sherwin-Williams Co.
- C. Pittsburgh Paints, PPG Pittsburgh Paints, including Glidden Professional.
- D. Vista Paint Co.
- E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide painting and finishing of exposed items and surfaces requiring field painting and finishing including shop primed items.
 - 1. Definition: "Painting" and "coating" as used herein means systems including primers, emulsions, enamels, stains, sealers and fillers, whether used as prime, intermediate or finish coats.
- B. Regulatory Requirements:
 - 1. Volatile Organic Compound (VOC) Emissions: Furnish materials approved for use by applicable air quality management district for limitations of volatile organic compounds for architectural or special coatings as applicable.
- C. Material Quality: Provide top line quality commercial grade (professional painter) paints; materials not bearing manufacturer's identification as their top line product shall not be acceptable.
 - 1. Primers: Provide premium grade primers recommended by paint manufacturer for substrates indicated and for finish systems specified.
 - 2. Undercoats and Barrier Coats: Provide undercoat paints produced by same manufacturer as finish coats; use only thinners approved by paint manufacturer and use only within recommended limits.
 - 3. Finish Coats: Provide finish coats capable of being washed with mild detergent without loss of color, sheen, or pigments.
 - a. Color pigments: Pure, non-fading, applicable types to suit substrates and service indicated; no lead content permitted.
 - 4. Finish Coat Coordination: Provide finish coats which are compatible with prime paints, undercoats, and barrier coats used.
 - a. Review other Specification sections in which prime paints are provided; ensure compatibility of total coatings systems.

- b. Upon request from other trades furnish information on characteristics of finish materials proposed for use.
 - c. Provide barrier coats over incompatible primers or remove and prime as required.
 - d. Notify Architect in writing of any anticipated problems in use of specified coating systems with substrates primed by others.
- D. Colors and Finishes: Prior to commencement of painting work, Architect will furnish color chips for surfaces to be painted.
 - 1. Use of proprietary names in color selection is not intended to imply exclusion of equivalent products of other manufacturers.
 - 2. Final acceptance of colors will be from samples applied on site.
 - 3. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Inspection: Examine areas and conditions under which painting work is to be applied.
 - 1. Start of painting work indicates acceptance of surfaces and conditions of surfaces and conditions within any area.
 - 2. Where exposed items or surfaces are not specifically mentioned in Schedules, paint same as adjacent similar materials or areas.
 - 3. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to a durable paint film.
- B. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as specified for substrate condition.
 - 1. Existing Painted Finishes:
 - a. Clean existing painted surfaces and remove oil, grease, dust, stains, scale, efflorescence, mildew, mold, algae, blisters, and non-adhering paint.
 - b. Measure adhesion of existing paints using ASTM D3359 tape test; remove existing coatings where poor adhesion is indicated.
 - c. Feather edges of severely deteriorated paint where several coats are removed as part of cleaning, to provide smooth transition for new paint.
 - d. Fill holes, cracks, and defects and fill and sand smooth, ready for new paint finish.

- C. Remove hardware, accessories, and items in place and not to be painted, or provide protection prior to surface preparation and painting; after painting reinstall removed items.
- D. Clean surfaces before applying paint; remove oil and grease prior to mechanical cleaning; program cleaning so contaminants from cleaning process do not fall onto wet, newly painted surfaces.
- E. Cementitious Materials: Prepare by removing efflorescence, chalk, dirt, grease, oils, and by roughening as required to remove glaze.
 - 1. Determine alkalinity and moisture content of surfaces to be painted.
 - 2. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, neutralize before application of paint.
 - 3. Do not paint over surfaces where moisture content exceeds manufacturer's printed directions.
- F. Wood: Clean wood surfaces of dirt, oil, and other foreign substances; sandpaper smooth surfaces exposed to view and dust off.
 - 1. Scrape and clean seasoned knots and apply thin coat of recommended knot sealer, before application of priming coat.
 - 2. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job; prime edges, ends, faces, undersides, and backsides of wood.
 - 3. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler; sandpaper smooth when dry.
- G. Ferrous Metals: Touch up shop-applied prime coats wherever damaged using same type of primer as applied in shop or barrier coat compatible with finish paint.
 - 1. Bare Surfaces: Clean surfaces that are not galvanized or shop-coated, of oil, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.
 - 2. Galvanized Surfaces: Clean free of oil and surface contaminants, using non-petroleum-based solvent; primer and touch-up primer to be zinc-rich primer.
- H. Mix painting materials in accordance with manufacturer's directions.
- I. Store materials in tightly covered containers; maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.
- J. Stir materials before application to produce mixture of uniform density and stir as required during application; do not stir surface film into material, if necessary, strain material before using.

3.2 APPLICATION

- A. Apply paint in accordance with manufacturer's directions; use applicators and techniques best suited for substrate and type of material being applied.

1. Apply additional coats when stains or blemishes show through final coat, until paint is a uniform finish, color and appearance.
 2. Provide extra attention during application to assure dry film thickness at corners and crevices is equivalent to that of flat surfaces.
 3. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces; paint surfaces behind permanently fixed equipment and furniture with prime coat only.
 4. Finish doors on tops, bottoms and side edges same as faces.
 5. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 6. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.
 7. Sand lightly between coats when recommended by system manufacturer.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated or prepared for painting as soon as practicable after preparation.
1. Allow time between successive coatings to permit proper drying.
 2. Do not recoat until paint feels firm and does not deform or feel sticky under moderate thumb pressure.
- C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as recommended by coating manufacturer.
- D. Prime Coats: Apply to items not previously primed; recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat.
- E. Finish Coats: Provide even texture; leave no laps, irregularity in texture, skid marks, or other surface imperfections.
1. Opaque Finishes: Provide opaque, uniform finish, color and coverage; cloudiness, spotting, holidays, brush marks, runs, sags, ropiness, and other surface imperfections are not acceptable.
 2. Transparent and Stained Finishes: Produce glass smooth surface film of even luster; provide with no cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, and other surface imperfections.
- F. Completed Work: Match approved samples for color, texture and coverage; remove, refinish or repaint work not accepted.

3.3 PAINTING SCHEDULE

A. Exterior Work: Provide following paint systems and sheens unless otherwise indicated.

1. Metal: Semigloss sheen.
 - a. 1st Coat: Touch-up primer, prime if none.
 - b. 2nd and 3rd Coat: Exterior 100% acrylic enamel.
2. Metal: High-performance coating specified in Section 09 96 70.
3. Concrete: Flat sheen.
 - a. 1st and 2nd Coat: Exterior acrylic latex emulsion.
4. Plaster: Flat sheen.
 - a. 1st and 2nd Coat: 100% Acrylic
5. Concrete Masonry Units: Flat sheen.
 - a. 1st Coat: Surface filler.
 - b. 2nd and 3rd Coat: Heavy body waterproof acrylic emulsion.
 - c. Apply filler at rate to ensure coverage with pores filled.
6. Concrete Masonry Units: Flat sheen.
 - a. Refer to Section 09 96 80 – Elastomeric Coating.
7. Fiber Cement Siding: Flat sheen.
 - a. 1st Coat: Alkali resistant primer.
 - b. 2nd and 3rd Coat: Exterior 100% acrylic enamel.
8. Opaque Finished Wood: Semigloss sheen.
 - a. 1st Coat: Primer undercoat.
 - b. 2nd and 3rd Coat: Exterior 100% acrylic enamel.
9. Stained Wood: Flat sheen.
 - a. 1st Coat: Exterior semi-transparent penetrating stain.
10. Natural Finish Wood: Flat sheen.
 - a. 1st Coat: Exterior clear penetrating wood sealer and preservative.
11. Traffic Line Paint: Manufacturer's standard sheen; colors as required by line or symbol; blue for handicapped parking spaces.
 - a. 1st and 2nd Coat: Water based acrylic/epoxy traffic line paint; other systems subject to prior approval by Architect.

B. Interior Work: Provide following paint systems and sheens unless otherwise indicated.

1. Gypsum Board Systems: Eggshell (satin) sheen at walls, flat sheen at ceilings, semigloss sheen at toilet rooms.
 - a. 1st Coat: Universal primer.
 - b. 2nd and 3rd Coat: Interior latex or acrylic latex emulsion.
2. Metal: Semigloss sheen.
 - a. 1st Coat: Touch-up primer, prime if none.
 - b. 2nd and 3rd Coat: 100% acrylic enamel.
3. Opaque Finished Wood: Semigloss sheen.
 - a. 1st Coat: Primer undercoat.
 - b. 2nd and 3rd Coat: 100% acrylic enamel.
4. Stained Wood: Satin rubbed sheen.
 - a. 1st Coat: Wood stain.
 - b. 2nd Coat: Sanding sealer.
 - c. 3rd and 4th Coat: Acrylic modified urethane.
 - d. Fill open grained wood with filler and wipe before 2nd coat.
5. Transparent Finished Wood: Satin rubbed sheen.
 - a. 1st Coat: Bleached shellac.
 - b. 2nd and 3rd Coat: Acrylic modified urethane rubbing varnish.
 - c. Fill open grained wood with filler and wipe before 1st coat.
6. Concrete: Flat sheen.
 - a. 1st Coat: Primer sealer.
 - b. 2nd and 3rd Coat: Interior latex emulsion.
7. Plaster: Eggshell (satin) sheen at walls, flat sheen at ceilings, semigloss sheen at toilet rooms.
 - a. 1st Coat: Latex primer-sealer.
 - b. 2nd and 3rd Coat: Interior acrylic latex emulsion.
8. Cotton and Canvas Covering Over Insulation: Flat sheen.
 - a. 1st (Size) Coat: Interior latex emulsion.
 - b. 2nd Coat: Interior latex emulsion.
 - c. Add fungicidal agent to render fabric mildew proof.

C. Sheens: Comply with ASTM D523, reflectance of paint.

1. Flat: 1-10.
2. Satin: 15-30.
3. Eggshell: 30-45.

4. Semigloss: 45-75.
5. Gloss: 75-100.

3.2 CLEAN-UP, PROTECTION, AND REPAIR

- A. Clean-Up: During progress of work, remove discarded paint materials, rubbish, cans and rags from site at end of each workday.
 1. Clean glass and paint-spattered surfaces immediately by proper methods of washing and scraping, using care not to scratch or damage finished surfaces.
- B. Protection: Protect work of other trades, whether to be painted or not; correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
 1. Provide "Wet Paint" signs to protect newly painted finishes.
 2. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.
- C. Repair: At completion of work of other trades, touch-up and restore damaged surfaces or defaced painted surfaces.

END OF SECTION

SECTION 10 11 00

VISUAL DISPLAY BOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide visual display boards including liquid marker type whiteboards and cork tackboards with trim, hardware, and accessories as required for complete installation.

1.2 SUBMITTALS

- A. Shop Drawings: Clearly indicate board sizes and layout, method of attachment, accessories, trim profiles, details and finish.
- B. Samples: Furnish sample whiteboard and tackboard surfaces with samples of aluminum trim and chalk rail, in selected colors and finish.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver materials to site until areas in which they are to be installed are ready to receive them.
- B. Deliver materials to site in protective covering in a manner to protect finishes.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Claridge Products and Equipment, Inc.
- B. Greensteel Division of PolyVision Corporation.
- C. ADP Lemco Inc.
- D. AARCO Products Inc.
- E. K-PRO Specialty Products.
- F. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide visual display boards including liquid marker type whiteboards and cork tackboards with trim, hardware, and accessories.
- B. Steel Sheet for Porcelain Enameling: ASTM A424, minimum 24 gage.
- C. Aluminum Extrusions: ASTM B221, minimum 0.062" wall thickness.

- D. Aluminum Sheet: ASTM B209, minimum 0.015" thick.
- E. Galvanized Steel Sheet: ASTM A1011 or A1008, Class 1; ASTM A924 and A653, G90 coating; minimum 26 gage (0.0179").
- F. Tempered Hardboard: Manufacturer's standard material.
- G. Plywood: PS 1, manufacturer's standard.

2.3 FABRICATION

- A. Whiteboards: Porcelain writing surface manufactured specifically for use with liquid marker systems.
 - 1. Type:
 - a. Claridge/LCS Liquid Chalk System.
 - b. Greensteel/Dry Marker Board.
 - c. ADP Lemco/Markerboards.
 - d. AARCO/Porcelain Steel Markerboards.
 - e. K-PRO/Porcelain Steel Markerboards.
 - f. Substitutions: Refer to Section 01 25 00.
 - 2. Core: Minimum 3/8" thick plywood.
 - 3. Balance porcelain writing surface with aluminum or sheet steel backing, aluminum foil is not acceptable.
 - 4. Colors: white
- B. Attachment Hardware: Manufacturer's standard fully concealed attachment system for securing units to wall surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Securely mount whiteboards and tackboards in accordance with manufacturer's recommendations, level and true to line.
 - 1. Multiple Units: Provide flush, butt, hairline joints to ensure a smooth writing surface between whiteboards.
 - 2. Sliding Units: Provide rattle and chatter-free operation; boards to move with maximum 5-pounds pressure and to stop and hold in any position.
- B. Cleaning: At completion of work, clean surfaces and trim, leaving ready for use.

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide general signage as indicated complete with attachment devices and accessories as required for complete installation.
- B. Related Sections:
 - 1. Section 09 90 00: Traffic line paint.
 - 2. Section 10 44 00: Fire extinguisher cabinet graphics.

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature and indicate each sign type, style, color, and method of attachment.
- B. Shop Drawings: Furnish listing of sign types, lettering and locations, along with dimensions of each sign.
 - 1. Computerized Output: Furnish computerized samples of signs and graphics at full scale duplicating final appearance.
 - 2. Dimensional Letter Signs: Furnish complete shop drawings regarding fabrication and method of attachment of dimension letter signs.
 - 3. Photoluminescent Egress Path Signage: Submit complete shop drawings indicating locations of luminous egress path markings and signage.
- C. Samples: Furnish full size samples where requested.
- D. Certification: Furnish manufacturer certification that photoluminescent egress path markings and signage conform to California Building Code requirements.

1.3 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Package separately or in like groups of names, labeled as to names enclosed; include installation template, attachment system and installation instructions.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. ASI Modulex, ASI Sign Systems, Inc.
- B. Mohawk Sign Systems.
- C. Vomar Products, Inc.
- D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide signage as indicated with attachment devices and accessories.
- B. Regulatory Requirements: Provide signs for assuring access for persons with disabilities in accordance with state and federal regulations.
 - 1. California Regulations: Comply with California Building Code.
 - 2. Federal Regulations: Comply with Americans with Disabilities Act (ADA) Standards.
- C. Dimensional Letter Signage: Provide individual letter signs as indicated.
 - 1. Aluminum: Manufacturer's standard for individual letter signs.
 - a. Finish: Clear anodized finish, AA-M12C22A41, Class I, AAMA 607.1.
 - 2. Stainless Steel: ASTM A666, Type 304 nonmagnetic corrosion resistant stainless steel with No. 4 satin directional polish finish.
 - 3. Fabrication: Fabricate dimensional letters as indicated, of minimum 0.25" plate or casting with edges and corners smooth and finished to match adjacent metal finishes.
 - 4. Attachment: Secure letters using connections concealed after installation; method subject to Architect approval.
 - a. Take care back welding does not damage exposed sign surfaces.
- D. Toilet Room Door Signs: Provide door signs conforming to California requirements for signs for toilet rooms; concealed mounting system.
 - 1. Material, Plastic: Manufacturer's standard colored plastic/photopolymer signs.
 - a. Texture: Smooth.
 - b. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.

2. Material:
 - a. Aluminum: Manufacturer's standard for individual letter signs.
 - 1) Finish: Clear anodized finish, AA-M12C22A41, Class I, AAMA 607.1.
 - b. Stainless Steel: ASTM A666, Type 304 nonmagnetic corrosion resistant stainless steel with No. 4 satin directional polish finish.
3. Total Thickness: 0.25".
4. Provide signs required by California Code of Regulations Title 24.
 - a. Men's Room: 12" equilateral triangle, vertex pointing up.
 - b. Women's Room: 12" diameter circle.
 - c. Unisex Toilet: 12" diameter circle with equilateral triangle, vertex pointing up, superimposed on the circle; circle and triangle each 0.25" thick.
 - 1) Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
5. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
6. Symbols: As selected from manufacturer's standard symbols.
7. Adhesive: Type as recommended by sign manufacturer for type of substrate involved.
- E. Toilet Room Wall Signs: Provide signs conforming to California Building Code and ADA Standards for signs for permanent rooms, with inset symbols and with raised and Braille characters; concealed mounting system.
 1. Material, Plastic: Manufacturer's standard colored plastic/photopolymer signs.
 - a. Texture: Smooth.
 2. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
 3. Material:
 - a. Aluminum: Manufacturer's standard for individual letter signs.
 - 1) Finish: Clear anodized finish, AA-M12C22A41, Class I, AAMA 607.1.
 - b. Stainless Steel: ASTM A666, Type 304 nonmagnetic corrosion resistant stainless steel with No. 4 satin directional polish finish.
 4. Comply with California Building Code and ADA Standards for raised and Braille characters, pictorial symbols, finish, and contrasts requirements.

- F. Entry Decals: Provide minimum 6" square decals with international handicapped symbol white on blue background with white border, applied to glass at accessible entry doors of existing buildings where all entry doors are not accessible.
- G. Porcelain Signs at Parking: Provide porcelain enamel on steel sign with beaded text and symbols meeting requirements of California Building Standards Code and with ADA Standards.
 - 1. At entry to parking provide state required sign indicating unauthorized vehicles parking in accessible parking spaces may be towed at owner's expense using exact wording required by CBC.
 - 2. Verify location and telephone number of location vehicle is to be towed with Owner; place this information as permanent part of sign wording.
 - 3. At parking spaces provide California required reflectorized sign, minimum 70 sq. inches, with symbol indicating accessibility.
 - 4. At van accessible parking spaces provide required "VAN PARKING" signs.
- H. Tactile Exit Door Signs: Provide colored plastic/photopolymer signs, conforming to California Building Code Section 1011.3 and ADA Standards for signs for permanent rooms, with tactile raised and Braille characters; concealed mounting system.
 - 1. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
 - 2. Size and Style: As indicated on Drawings.
- I. Room Identification and Direction Signs: Provide signs conforming to California and ADA Standards for permanent signs, total thickness 0.125"; provide raised and Braille characters conforming to California and ADA Standards; concealed mounting.
 - 1. Material, Plastic: Manufacturer's standard colored plastic/photopolymer signs.
 - a. Texture: Smooth.
 - 2. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
 - 3. Material:
 - a. Aluminum: Manufacturer's standard for individual letter signs.
 - 1) Finish: Clear anodized finish, AA-M12C22A41, Class I, AAMA 607.1.
 - b. Stainless Steel: ASTM A666, Type 304 nonmagnetic corrosion resistant stainless steel with No. 4 satin directional polish finish.
 - 4. Sizes and Styles: As indicated on Drawings, as directed by Architect where not otherwise indicated.

- J. Applied Copy Signs and Graphics: Letters and graphics as indicated on Drawings; Contractor option of silk-screen or vinyl applied.
 - 1. Silk-screen Signs and Graphics: Computer design screens for signs and graphics to designs and criteria established by Architect.
 - a. Silk-screen Lacquer: Match Advanced Screen Products/Industrial Gloss Lacquer Silk-screen Ink; colors as selected by Architect.
 - 2. Vinyl Signs and Graphics: Computer design vinyl signs and graphics to designs and criteria established by Architect.
 - a. Vinyl: Opaque non-reflective vinyl film, minimum 0.0035" thick, with pressure sensitive adhesive backing suitable for applications indicated; match 3M/Scotchcal Vinyl Film.
 - 3. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- K. Tactile Emergency Evacuation Signs: Silk-screened polycarbonate with screening on back and with tactile and Braille information conforming to California requirements and ADA Standards.
 - 1. Information: Provide sign system with information as required by applicable authorities for emergency egress.
 - 2. Silk-Screen Colors:
 - a. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
 - b. Silk-screen Lacquer: Match Advanced Screen Products/Industrial Gloss Lacquer Silk-screen Ink; colors as selected by Architect.
 - 3. Size and Style: As indicated on Drawings and acceptable to applicable authorities.
 - 4. Attachment: Method subject to Architect approval.
 - 5. Photoluminescent or Tritium self-luminous exit signs, where indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install signs in accordance with manufacturer recommendations and installation instructions, free from distortions and defects.
- B. Dimensional Letter Signage: Locate dimensional letters with spacing based on full-size computer-generated installation drawings secured to structure as required to resist anticipated loads.
 - 1. Final Location: As approved in field by Architect based on full size drawings.

- C. Toilet Room Door Signs: Install signs on doors after doors are painted and finished.
 - 1. Location: Mount signs with centerline of sign between 58" and 60" height as required by applicable code.
 - 2. Install centered and level, in line, in accordance with the manufacturer's recommendations.
 - 3. Clean and polish, remove excess adhesive.
- D. Toilet Room Wall Signs: Install signs on walls after surfaces on which they are to be mounted are painted and finished.
 - 1. Location: Mount signs at 48" to 60" height as required by applicable codes on strike side of door.
 - 2. Location: Mount signs with tactile characters 48" minimum (baseline of lowest Braille cells) and 60" maximum (baseline of highest line of raised characters) above finished floor and with on strike side of door for room identification signs as required by applicable codes, at heights indicated on details.
 - 3. Install level, in line, in accordance with California Building Code and ADA Standards to allow a person to approach within 3" of signs without being within a door swing and without encountering protruding objects.
 - 4. Clean and polish, remove excess adhesive.
- E. Entry Signs: Install in locations as approved by Architect.
- F. Stair Signs: Install signs inside stairwell after walls are finished, at locations immediately adjacent to door on strike side as required by referenced code, readily visible when door is open.
 - 1. Location: Mount signs at 48" to 60" height as required by applicable codes.
- G. Parking Signs: Provide mounting hardware, including painted posts, as needed; mount signs at heights required by state code.
 - 1. Install parking entry sign at location as directed by Architect.
- H. Tactile Exit Door Signs: Install at doors with lighted "EXIT" signs; apply after walls are finished.
 - 1. Location: Mount signs at 48" to 60" height as required by applicable codes on strike side of door.
 - 2. Install level, in line, in accordance with the manufacturer's recommendations and ADA Standards to allow a person to approach within 3" of signs without being within a door swing and without encountering protruding objects.
 - 3. Clean and polish, remove excess adhesive.

- I. Room Identification and Direction Signs: Install signs after walls are finished.
 - 1. Location: Mount signs at 48" to 60" height as required by applicable codes on strike side of door for room identification signs, where indicated for direction signs.
 - 2. Room Identification Signs Location: Mount signs with tactile characters 48" minimum (baseline of lowest Braille cells) and 60" maximum (baseline of highest line of raised characters) above finished floor and with on strike side of door for room identification signs and where indicated for directional signs.
 - 3. Install signs level, in line, in accordance with the manufacturer's recommendations, California Building Code and ADA Standards.
 - 4. Install room identification signs at doors to allow a person to approach within 3" of signs without being within a door swing and without encountering protruding objects.
 - 5. Clean and polish, remove excess adhesive.
- J. Applied Copy Signs and Graphics: Examine surfaces and construction for conditions adversely affecting installation, performance and quality of work.
 - 1. Apply signage and graphics centered and level, in line, in accordance with manufacturer's recommendations.
- K. Emergency Evacuation Signs: Install signs after walls are finished.
 - 1. Location: Mount signs at locations indicated, as directed by Architect and applicable authorities if not otherwise indicated.
 - 2. Install signs level and in accordance with the manufacturer's recommendations and requirements of applicable authorities.
 - 3. Clean and polish.
- L. Photoluminescent Egress Path Markings and Signage: Install exit path marking and signage as required by applicable codes.

END OF SECTION

SECTION 10 21 20

PHENOLIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide phenolic plastic partitions for toilet compartments including hardware, attachment devices, and integral accessories as required for complete installation.
- B. Related Sections:
 - 1. Section 10 28 00: Toilet accessories.

1.2 REFERENCES

- A. Americans with Disabilities Act (ADA) Standards.
- B. California Building Code: California Code of Regulations, Title 24, Part 2, requirements for providing accessibility for persons with disabilities.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's literature.
- B. Shop Drawings: Clearly indicate partition layouts, swing of doors, elevations, anchorage and mounting details, panel construction, hardware, finishes and relevant dimensions.
- C. Samples: Submit samples of metal finish.

1.4 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives, sealants, and caulks.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Global Partitions, an ASI Group Company.
- B. Flush Metal Partition Corp.
- C. Bradley Corporation Mills Partitions.
- D. General Partitions Mfg. Corp.
- E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide phenolic plastic partitions including hardware, attachment devices, and integral accessories.
 - 1. Toilet Compartment Type: Floor mounted, overhead braced.
- B. Regulatory Requirements, Access: Comply with California Building Code and Americans with Disabilities Act (ADA) Standards.
 - 1. Spacing: Provide minimum 60" clear width, and front space as applicable for type of compartment.
 - 2. Reinforcing: Provide reinforcing for grab bars indicated to be partition mounted.
- C. Regulatory Requirements, Fire Rating: Comply with requirements for fire ratings for interior finishes with either ASTM E84 or NFPA 286, Corner Burn Test as applicable.
- D. Phenolic Panels: Manufacturer's standard phenolic core with high pressure melamine color surface on faces, with exposed black phenolic edges burnished and slightly rounded.
 - 1. Color: ASI: charcoal
- E. Pilaster Shoes: 3" high; ASTM A666, Type 304, No. 4 polished finish; stainless steel.
- F. Attachments, Screws and Bolts: Stainless steel; tamper proof type; heavy duty extruded aluminum brackets.
- G. Hardware: Manufacturer's standard chrome plated or similar finish.
 - 1. Coat Hook/Bumper: Combination coat hook and bumper unit, maximum 48" above finished floor.
- H. Overhead Braced Partition Headrails: 1" by 1-5/8" tubular metal, with cast socket type wall brackets.
 - 1. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.

2.3 FABRICATION

- A. Fabricate: Manufacturer's standard construction.
- B. Pilasters: 1-1/4" thick, constructed same as doors, of sizes required to suit cubicle widths and spacing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine site conditions to which work is to be applied.

- B. Take site dimensions affecting this work.
- C. Ensure correct spacing and size of plumbing fixtures; take special note of fixtures in compartments indicated to be designed for persons with disabilities to assure clearances complying with access regulations.
- D. Ensure correct location of built-in framing, anchorage, and bracing, where required.

3.2 INSTALLATION

- A. Install units in accordance with manufacturer recommendations and installation instructions, secure, plumb, level, and square.
- B. Leave 1/2" space between wall, panels and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to bracket with through sleeve tamper proof bolts and nuts.
- E. Locate headrail joints at pilaster center lines.
- F. Provide for adjustment of floor variations with screw jack through steel saddles integral with pilaster; conceal floor fastenings with stainless steel shoes.
- G. Adjust and align hardware to uniform clearance at vertical edges of doors not exceeding 3/16".
- H. Adjust hinges to locate doors in partial open position when unlatched, except adjust hinges to return doors to closed position at stalls designed for use by persons with disabilities.
- I. Anchor urinal screen panels to walls with either two panel brackets each or continuous angle brackets on both sides.

3.3 CLEANING

- A. Field touch-up of scratches and defaced finishes will not be permitted; replace damaged, scratched and marred defective materials with new, undamaged materials.
- B. Remove protective coverings and clean surfaces in accordance with manufacturer recommendations.

END OF SECTION

SECTION 10 22 20

OPERABLE PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide manually operated, top supported, operable partitions with retractable seals, including hardware and accessories as required for complete, operable system.
 - 1. Acoustical Closure: Review Contract Documents to ensure acoustical closure of adjacent construction matches operable partition acoustical performance to prevent flanking sound around partition into adjacent spaces.
 - a. Provide additional construction as required to ensure acoustical closure.
 - 2. Support System: Provide structural steel support system connected to building structure at points approved by Architect.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Design/Build Requirements: Provide services of registered structural engineer licensed in California with experience designing structural support systems for operable partitions.
 - 1. Distribute loads to locations on building structure capable of supporting system without detrimental effects.
- B. Pre-Installation Meeting: Convene not less than one week prior to commencing work of this Section. Require attendance of those directly affecting work of this Section.
 - 1. Review installation procedures and coordination required with related work.

1.3 SUBMITTALS

- A. Product Data: Furnish materials description, operation and maintenance instructions.
- B. Shop Drawings: Show partition and track layout, details of head, jamb and sill conditions, stacking arrangement, hardware and operating mechanism.
 - 1. Indicate details of acoustical barrier over partitions system.
 - 2. Provide template drawings for items supported or anchored by permanent construction.
 - 3. Indicate details of pass doors.
- C. Samples: Furnish samples of panel finish and edge construction.

D. Test Reports: Furnish copies of certificates by independent testing laboratories for following:

1. STC rating.
2. Flame spread classification.
1. Fire resistance ratings.
2. Field STC Tests: Furnish previous project test reports.

E. Certificates:

1. Manufacturer Certification: Furnish manufacturer's certification indicating system complies with Contract Documents.
2. Installer Acceptance: Furnish letter from manufacturer indicating acceptance of installer for this Project.
3. Design/Build Engineer Certification: Furnish certification from California registered engineer indicating structural support system complies with Contract Documents and applicable codes.

1.4 QUALITY ASSURANCE

A. Qualification of Installers: Minimum five years successful experience in installing operable partitions and accessories on comparable projects.

1. Acceptable to manufacturer of operable partition.

1.5 WARRANTY

A. Extended Correction Period: Provide for correcting failure of operable partition system from proper operation, including acoustical characteristics.

1. Special Warranty Period: Two years.

B. Manufacturer's Warranty: Submit manufacturer's warranty including special manufacturer services as required for manufacturer's warranty.

1. Period: Not less than 10 years.
2. Manufacturer's warranty shall not detract from requirements of extended correction period nor from Owner's rights under implied and expressed warranties regardless of wording of manufacturer's warranty.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Advanced Equipment Corporation (AEC).
- B. Modernfold, a DORMA Group Company.
- C. Hufcor, Inc.

- D. Industrial Acoustics Co., Inc.
- E. Kwik-Wall Company (**Basis of Design**)
- F. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide manually operated operable partitions with retractable seals and including hardware and accessories.
 - 1. Partition Type: Top-supported, side-stacking, manually operated, with flush panels; manufacturer's STC 50 or 52 system as required to achieve required field performance requirements.
 - a. **Basis of Design:** Kwik-Wall Company 3030 Series system, STC 50, Vinyl Surface (Lino Skylight), Trim to be Satin Gray.
 - 2. Acoustical Closure: Provide acoustical closure of adjacent construction as required to match operable partition acoustical performance and as required to prevent flanking sound around partition into adjacent spaces.
 - 3. Structural Support: Provide structural support for operable partitions.
- B. Design Requirements: Support system to be designed by registered professional structural engineer licensed in California.
 - 1. Distribute loads to locations on building structure capable of supporting system without detrimental effects.
- C. Fire Performance Requirements: Provide products listed by Underwriters Laboratories (UL), or similar independent laboratory acceptable to applicable authorities.
 - 1. Flame Spread/Smoke Generation: Provide products meeting code requirements for maximum 25 flame-spread and 450 smoke developed; Class A, ASTM E84.
 - 2. Fire Rated Assemblies: UL rated as 1-hour fire rated partition assembly; UL10B test procedure; partitions listed by UL or similar independent laboratory acceptable to applicable authorities.
- D. Field Acoustical Performance Requirements: Provide minimum three field sound transmission rating tests on previous projects of similar size and scope indicating system to be provided has minimum FSTC of NIC 40.
 - 1. Ratings: Determined in accordance with ASTM E413; tests by Architect approved independent testing laboratory.
 - 2. Field Sound Transmission Rating: Minimum FSTC of NIC 40 when tested in accordance with ASTM E336, using reverberant-field procedure and full octave bands rather than one-third octave bands.

- E. Partition Type: Top-supported, side-stacking, manually operated, with flush panels.
 - 1. Panel Configuration: Individual panels.
 - 2. Panel Configuration: Paired panels.
 - 3. Panel Configuration: Continuously hinged panels.
 - 4. Fire Rating: Minimum 1-hour fire rating.
 - 5. Pass Doors: Flush doors integral with partition panel; complete with hardware.
- F. Panel Construction: Factory assembled, consisting of minimum 16 gage welded steel channel perimeter frame with intermediate stiles, high density sound retardant insulation.
 - 1. Panel Thickness: Nominal 3" to 4" thick; review Drawings for space provided for panel storage; provide panel system suitable of allowable space.
 - a. Notify Architect during bidding if Project design requires potential modification for system to comply with Contract Document.
 - b. Failure to notify Architect during bidding signifies acceptance of conditions indicated.
 - 2. Panel Skins: Minimum 24-gage steel with rust inhibitive prime coat of paint.
 - 3. Panel Support Bolts: Minimum 1/2" diameter; of fail-safe design that prevents loosening or backing out after panels have been installed.
 - 4. Panel Materials: Incombustible, moisture resistant, and dimensionally stable.
 - 5. Construction: All steel construction.
- G. Track System: Overhead track designed for extra heavy duty; secured to structural support system by adjustable bolts.
 - 1. Panel Supports: Ball bearing trolley assembly, capable of universal movement, turning on a central bearing and shall not require radius turns or switching mechanisms.
- H. Deflection Compensation: Design system to accommodate specified long-term dead load deflection of up to 1/2" at any point in span while maintaining operational and acoustical qualities.
- I. Seals: Provide system with single mechanism to activate floor seals; seals shall not contact floor or track during movement of panels.
 - 1. Floor Seals: Durometer rating compatible with floor surfaces.
 - 2. Vertical Seals: Manufacturer's standard as required to achieve acoustical performance specified.

3. Seal Materials: Resistant to fatigue and cleaning compounds and shall not mar floor or ceiling finishes.
4. Floor Guide and Floor Attachments: Not permitted.
- J. Fixed and Operable Closure Jambs: Acoustical type designed to maintain acoustical seal at perimeter walls and junctions of operable partition; security affix to building walls.
- K. Pass Doors: Manufacturer standard pass doors meeting quality control requirements, including acoustic characteristics.
 1. Type: Single leaf type minimum 32" clear width and 84" high.
 2. Hinges: Minimum two hinges of high tempered alloy steel with BHMA 625 (US26D) chrome finish.
 - a. Hinge Test: Hinges provided shall be identical to hinges cycled without failure a minimum of 125,000 times while supporting door leaf weighing minimum of 350 lb.
 3. Latch:
 - a. Non-Fire Rated Doors: No latching mechanism; recess pull handles on both sides of door leaf; door capable of opening from inside by leaning or pushing against door leaf unless low profile panic hardware required by authorities.
 - b. Fire-Rated Doors: Low profile panic hardware and concealed closer, UL rated.
 4. Jamb Seals: Manufacturer's standard acoustic seals at head and side jambs.
 5. Floor Seals: Provide flexible compression type; design cam-action of hinges and manual closing of door to compress floor seal and maintain acoustical performance of partition.
 - a. Raised Sills and Automatic Threshold Closures: Not permitted.
 6. Factory Assembly: Factory assemble complete door unit and adjust with hardware and seals prior to shipment.
- L. Exit Signs: Provide at pass doors designated as emergency egress doors; internally illuminated signs conforming to applicable codes; mounted on room side of panel face.
- M. System Supports and Anchors: ASTM A36 steel shapes as required to attach operable partitions to building structural system.
 1. Provide bracing at track intersections to resist panel impacts.
- N. Finish: Panel and door finish shall be heavy duty vinyl fabric.

1. Apply finish to panels in shop. Return into vertical panel seams and mechanically fasten with removable astragal at panel edge.
2. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine floor and overhead construction for conformance with tolerances; verify dimensions of in place and subsequent construction.
- B. Installation of partition shall constitute acceptance of existing conditions.

3.2 INSTALLATION

- A. Install operable partition system in accordance with manufacturer's recommendations and installation instructions as required to assure compliance with sound transmission test requirements.
 1. Comply with ANSI E557, Standard Recommended Practice for Architectural Application and Installation of Operable Partitions.
 2. Lubricate bearings and sliding parts; adjust to ensure smooth, easy operation.
 3. Match operable partitions for color and pattern by using partition sections from cartons in same sequence as manufactured and packaged.
 4. Broken, cracked, chipped, damaged, and deformed partitions are not acceptable.
- B. Upon completion of installation, test operation of partition in presence of Architect.
- C. Instruct Owner's personnel in operation and maintenance of partition.

3.3 FIELD QUALITY CONTROL

- A. Site Acoustical Tests: Determine field sound transmission class values in accordance with ASTM E336; tests by Architect approved independent testing laboratory.
 1. Field Sound Transmission Rating: Minimum FSTC of NIC 40 when tested in accordance with ASTM E336, using reverberant-field procedure and full octave bands rather than one-third octave bands.
 2. Failed Tests: Make corrections and re-test.

3.4 CLEANING

- A. Clean operable partition surfaces and adjacent surfaces soiled by operable partition work; avoid use of abrasive cleaners and solutions containing corrosive solvents.
 1. Remove and replace panels and adjacent construction damaged by installation or cleaning operations.

END OF SECTION

SECTION 10 26 10

STAINLESS STEEL CORNER GUARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide surface mounted stainless-steel corner guards, including mounting adhesive and accessories as required for complete finished installation.

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's product literature.
- B. Samples: Furnish samples of finish.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Babcock-Davis, Inc.
- B. In-Pro Corporation.
- C. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide surface mounted stainless-steel corner guards, including mounting adhesive and accessories.
- B. Corner Guard: ASTM A666, Type 304 stainless steel with satin finish; not less than 18-gage.
 - 1. Size: 3-1/2" by 3-1/2" by 48" high unless otherwise indicated.
- C. Attachment: Manufacturer's recommended adhesive for type of wall.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install stainless-steel corner guards in accordance with manufacturer's recommendations and installation instructions, straight and true to line.

END OF SECTION

SECTION 10 28 00

TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide toilet accessories with attachment hardware and rough-in frames as required for complete, operational installation.
- B. Related Sections:
 - 1. Section 08 80 00: Frameless glass mirrors.
 - 2. Section 10 21 10: Hardware for toilet partitions, including coat hook/bumper mounted on partition doors, and wall bumpers for out swinging doors.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's product data illustrating each accessory at large scale.
- B. Samples: Provide one sample of each type of fixture specified.

1.3 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver inserts and rough-in frames to jobsite at appropriate time for building in.
- B. Do not deliver accessories to site until rooms in which they are to be installed are ready to receive them.
- C. Pack accessories individually, protect each item and its finish.

1.5 SITE CONDITIONS

- A. Protect adjacent or adjoining finished surfaces from damage during installation of work of this section.
- B. Before starting work notify Architect in writing of conditions detrimental to installation or operation of units.
- C. Verify with Architect exact location of accessories.

1.6 WARRANTY

A. Extended Correction Period:

1. Replace mirrors which exhibit signs of desilvering or distortion.
2. Period: Two years.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Bobrick Washroom Equipment, Inc.
- B. Bradley Corporation.
- C. American Specialties, Inc.
- D. Manufacturers listed on Toilet Accessories Schedules.
- E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide toilet accessories with attachment hardware and rough-in frames.
 - 1. Provide standard materials and finishes for accessories listed; where more than one material or finish is available and not otherwise indicated provide as selected by Architect from manufacturer's standard materials and finishes.
- B. Regulatory Requirements - Access for Persons with Disabilities: Comply with California Building Standards Code and Americans with Disabilities Act (ADA) Standards.
- C. Stainless Steel Sheet: ASTM A666, commercial grade, Type 304, gages as standard with manufacturer of specified items.
- D. Stainless Steel Tubing: ASTM A269, commercial grade, seamless welded.
- E. Mirror Glass: ASTM C1036, q1 mirror select clear float glass with full silver coating, copper coating and organic coating; minimum 1/4" thick.
- F. Sheet Steel: ASTM A1008, cold rolled stretcher leveled; minimum G90 galvanized coating, ASTM A924 and A653.
- G. Adhesive: Epoxy type contact cement as recommended by accessory manufacturer; comply with applicable requirements for limitations on volatile organic compound (VOC) emissions.
- H. Fasteners, Screws, and Bolts: Hot dip galvanized; as recommended by accessory manufacturer for component and substrate.

- I. Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing and supply.

- 1. Provide minimum six keys to Owner representative.
 - 2. Coin Operated Units: Provide locked coin box keyed separately from standard units, coin operated units keyed alike.

2.3 FABRICATION

- A. Weld and grind smooth joints of fabricated components.
- B. Form exposed surfaces from one sheet of stock, free of joints.
- C. Fabricate units with tight seams and joints, exposed edges rolled; hang doors and access panels with continuous piano hinges; provide concealed anchorage where possible.
- D. Provide steel anchor plates and anchor components for installation on building finishes.
- E. Form surfaces flat without distortion; maintain flat surfaces without scratches and without dents; finish exposed edges eased, free of sharp edges where potential exists for physical contact.
- F. Back paint components where contact is made with building finishes, to prevent electrolysis.
- G. Hot-dip galvanize ferrous metal anchors and fastening devices.
- H. Assemble components in shop; package complete with anchors and fittings.

2.4 FINISHES

- A. Exposed Finishes: Stainless steel, number 4, satin finish; satin chrome finish acceptable where stainless steel not available for accessory item listed or scheduled.
- B. Concealed Surfaces: Treat and clean, spray-apply one coat primer and baked enamel finish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Provide templates and rough-in measurements.

3.2 INSTALLATION

- A. Install accessories in accordance with manufacturer's printed instructions using fasteners appropriate to substrate.
- B. Install true, plumb and level, securely and rigidly anchored to substrate.

- C. Use tamper-proof, security type fasteners.
- D. Adjust accessories for proper operation and verify mechanisms function smoothly.
- E. Replace damaged and defective items.
- F. Clean and polish exposed surfaces after removing temporary labels.

3.3 TOILET ACCESSORIES SCHEDULE

- A. Refer to Drawings.

END OF SECTION

SECTION 10 44 00

FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide semi-recessed cabinets for portable fire extinguishers with accessories as required for complete installation.

1. Fire Extinguishers: Owner furnished and installed.

- B. Related Sections:

1. Division 21: Fire protection systems.

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. J.L. Industries.
- B. Larsen's Manufacturing Co.
- C. Potter Roemer.
- D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide semi-recessed cabinets for portable fire extinguishers with accessories.
- B. Fire Extinguisher Cabinets: Provide semi-recessed mounting unless otherwise indicated, maximum 4" extension beyond wall finish surface, provide trim suitable for installation indicated.
1. Type:
- a. J.L. Industries/Ambassador Series.
 - b. Larsen's Mfg. Co./Architectural Series.
 - c. Potter Roemer/Alta Series.
 - d. Substitutions: Refer to Section 01 25 00.
2. Typical Cabinet Depth: Provide cabinets designed for space available in walls with fire extinguisher cabinets, and of depth to house 2A-10BC multi-purpose dry chemical type fire extinguisher.

3. Food Preparation Areas: Provide cabinets designed to house K Type fire extinguisher at locations indicated on Drawings or designated as food preparation areas where burning grease could be encountered.
4. Hazardous Areas (Garage): Provide cabinets designed to house 4A-60BC multi-purpose dry chemical type fire extinguisher at locations indicated on Drawings or designated as hazardous.
- C. Trim: Manufacturer's standard edge trim for specified models.
- D. Metal Gages: Provide manufacturer's standard gages for cabinets specified.
 1. Surface Mounted Cabinets (Garage): Minimum 18-gage typical, 20-gage at back.
- E. Construction: Mitered and welded one-piece tubular door frames; weld joints and grind smooth; manufacturer's standard steel box with white baked enamel interior finish and primed exterior finish.
 1. Steel Doors and Trim: Manufacturer's standard, prime coat finished.
 2. Doors: Break-glass type secured access, with inside latch and lock.
 3. Door Hardware: Continuous hinge permitting door to open 180-degrees.
- F. Fire Rated Wall Construction: Provide fire extinguisher cabinet manufacturer's material as required to maintain integrity of fire rated partitions where cabinets are in fire rated partitions.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine substrates and conditions under which fire extinguisher cabinets are to be installed.
- B. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install cabinets in locations and at mounting height to comply with requirements of governing authorities; prepare recesses in walls as required.
- B. Securely fasten to structure, square and plumb, in accordance with manufacturer's instructions.
 1. Wherever exact location of units is not shown, locate as directed by Architect.

3.3 IDENTIFICATION

- A. After installation and finishing is completed, silk screen or apply decal letters spelling "FIRE EXTINGUISHER" as applicable.
- B. Letter size, style and location as selected by Architect.

END OF SECTION

SECTION 10 73 00

ALUMINUM CANOPY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Helios Canopy
- B. Related Requirements: Division 1 – General Requirements

1.2 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.
- B. American Welding Society (AWS):
 - 1. Standard D1.2 – Structural Welding Code – Aluminum
- C. American Architectural Manufacturers Association (AAMA):
 - 1) Aluminum finishes AAMA 2603 Powder Coat
 - 2) Aluminum finishes AAMA 2605 Kynar
 - 3) Aluminum finishes AAMA 611 Anodize

1.3 SUBMITTALS

- A. Shop Drawings: Indicate size, material and finish. Include plan elevation pages to clearly outline canopy locations. Include installation procedures, details of joints, attachments and clearances. Provide lead time for product and note possible conflicts with standard line.
- B. Color charts showing manufacturer's full range of colors from standard line.

1.4 QUALITY ASSURANCE

- A. Provide metal storage system produced by single manufacturer, including necessary mounting brackets, accessories, fittings and fastenings.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver compacted storage system until building is enclosed and ready for installation.
- B. Protect system from damage during delivery, handling, storage and installation.

1.6 Warranty

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal canopies that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Specifications are based on Architectural Fabrication, Inc. – Helios Canopy. Architectural Fabrication, Inc. – Manufacturer and Installer is located at 2100 E. Richmond Avenue, Fort Worth, TX 76104. 800.962.8027. www.arch-fab.com
- B. Substitutions are acceptable assuming they comply with these specifications, are submitted based on Section 01 25 00 – Substitution Requirements and have a minimum 10 years' experience.

2.2 MATERIALS

- A. System Description: Aluminum Canopy
- B. Regulatory Requirements: Conform to California Building Code seismic requirements for storage and other applicable codes for seismic loading and safety requirements including CAL/OSHA.
- C. Framing: Gutter fascia, tube, angles: 6063-T5 alloy extruded aluminum
- D. Decking: Interlocking panels, extruded aluminum or sheet metal
- E. Hanger Rods: Zinc plated steel and powder coat (Prime and paint are not acceptable)
- F. Connections: Wall plates and canopy mounting brackets are to be aluminum.
- G. Hardware and Fasteners: Nuts, bolts, washers, clevis pins, screws, anchors and pipe spacers to be zinc plated or galvanized steel required to suit application and per pre-engineered canopy load requirements.
- H. Flashing: Shall be minimum 0.040-inch aluminum, fabricated to prevent leakage and sealed with Novaflex metal roof sealant in clear or color match. Other equivalent sealant is acceptable.
- I. Finish: Powder coat finish per ASTM D 3451, complying with finish manufacturer's written instructions for surface preparation including pretreatment, application, baking and minimum dry film thickness. Color to be selected from standard color line.

PART 3 - EXECUTION

3.1 FABRICATION

- A. Fabricate and preassemble canopies in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

3.2 INSTALLATION

- A. Install canopies per manufacturer's written instructions and as indicated on drawings.

- B. Locate and place canopies level, plumb and at indicated alignment with adjacent work.
- C. Use concealed anchors where possible.
- D. Repair damaged finishes so no evidence remains of corrective work. Return items to the factory that cannot be refinished in the field. Make required alterations and refinish entire unit or provide new units.
- E. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a coating of bituminous paint or elastomeric coating on surfaces that will be in contact with concrete, masonry or dissimilar metals.

END OF SECTION

SECTION 12 24 10

ELECTRICAL WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide electrically operated window shades, with hardware and accessories as required for complete, finished installation.

1.2 REFERENCES

- A. NFPA 701: Standard Methods of Fire Tests for Flame-Resistant Textiles and Films.
- B. FS CCC-T-191b: Flame Retardancy of Textiles.

1.3 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature.
- B. Shop Drawings: Show hardware, clearances and operation of shades with specified system.
 - 1. Layout of openings and control locations subject to Architect approval where not clearly indicated.
- C. Samples: Submit samples of each fabric indicating finishing of top, bottom and sides, and section of frame indicating finish.
- D. Certificate of Flame Proofing or Flame Resistance: Submit certification, recommendations and instructions for laundering of specified fabrics and maintenance of entire installation.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide window shades as complete units produced by one manufacturer, including hardware, accessory items, mounting brackets and fastenings.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver shades until installation area is ready for shade installation.
- B. Number and identify shades as to locations in Project.

1.6 SITE CONDITIONS

- A. Before installation, physically measure and inspect space after limiting conditions are established.
 - 1. Note floor and ceiling may not be level.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Mecho Shade Corporation.
- B. Lutron Electronics Co.
- C. SKYCO Shading Systems, Inc.
- D. Substitutions: Refer to Section 01 62 00.

2.2 MATERIALS

- A. System Description: Provide electrically operated window shades as indicated, with hardware and accessories.
 - 1. Solar Shades: Unframed.
 - 2. Blackout Shades: Side framed.
 - 3. Dual Solar and Blackout: Overlap mounted.
- B. Regulatory Requirements:
 - 1. Flame-Retardant Materials: Approved by California State Fire Marshal's Office.
 - 2. Fire Resistant Fabrics: Required to have passed one of following:
 - a. NFPA 701.
 - b. FS CCC-T-191, test 5903.
- C. Electrical Window Shades:
 - 1. Provide electrical shades as complete units produced by one manufacturer, including hardware, accessory items, mounting brackets and fastenings.
 - 2. Motor: Fractional horsepower asynchronous motor with reversible capacitor designed for intermittent operation; thermally protected, totally enclosed.
 - a. Provide solenoid activated disk brake and internal limit switches which are externally adjustable.
 - 3. Speed: Minimum 12 rpm.
 - 4. Control: Provide separate controls for blackout and solar shades.
 - a. Solar Shades: Maintained double pole, double throw switch located remotely; each room shall have one switch, multiple shades shall operate simultaneously.
 - 1) Motor logic controllers shall be provided where control of three or more shades is required.

- b. Blackout Shades: Momentary operated, double pole, double throw switch located remotely; each window shall have separate switch, with switches ganged together.
- D. Fabrics: Manufacturer's standard fire-resistant fabrics; colors and patterns as selected by Architect from manufacturer's full range.
 - 1. Solar Shades: Manufacturer's standard fire-resistant glass cloth fabric.
 - 2. Blackout Shades: Manufacturer's standard blackout shade system where indicated.
 - 3. Colors: Where color is not indicated on Drawings or Finish Schedule, provide standard color options for architect selection.
- E. Shade Pockets: Mount shades as indicated on Drawings, as approved by Architect where not otherwise indicated.
- F. Side Channels: Provide side channels for blackout shades; no sill channels.
- G. Accessories: Provide accessories, brackets, fittings and fastenings as necessary for proper operation and installation of shades; conceal fasteners or finish flush, painted to match exposed metal finish.
- H. Exposed Metal Finish:
 - 1. Colors: Where color is not indicated on Drawings or Finish Schedule, provide standard color, final selection by the architect.

2.3 FABRICATION

- A. Center Seams: Use single widths of fabric with no center seams for each shade.
- B. Shade Mounting System: Allow for shade removal and replacement without disassembling hardware assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect site conditions prior to installation for conditions that could affect proper installation and operation of shades.
- B. Beginning installation signifies acceptance of substrates and conditions.

3.2 INSTALLATION

- A. Install shades in accordance with manufacturer's recommendations and installation instructions.
 - 1. Install shades level, plumb, secure, and at proper height; cooperate with other trades for securing shades to substrate and finished surfaces.

2. Mount solar shades and blackout shades as indicated on Drawings to allow shade cloths to be adjacent.
 - B. Hang shades to be straight and even, employing hand sewing of seams and hems as necessary for carefully matched installation with even, horizontal top and bottom hems, and quiet, smoothly operating system.
 - C. Fabricate and install shades so when open, closed or while operating shades are not abraded by window frame, ceiling or sill.
- 3.3 ADJUSTING
- A. Thirty days after hanging of shades, inspect installation for fabric shrinkage or expansion or other variations and rehang as necessary for conformance to specified tolerances.

END OF SECTION

SECTION 12 93 00

SITE FURNISHINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. The extent of work in this Section includes the provision and installation of the site furnishing equipment and structures with all miscellaneous hardware, foundations and appurtenances required for installation.
- B. The general extent of work for this Section is shown on the drawings and includes, but is not limited to, the following:
 - 1. Curved Bench

1.03 QUALITY ASSURANCE

- A. All manufactured items shall be inspected and approved upon delivery.
- B. Unless otherwise specified, install all materials in accordance with manufacturer's recommendations.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and installation instructions for site furnishings conforming to requirements of Division 1 requirements for Submittal Procedures.
- B. Product Warranty, spare or replacement parts, and/or care instructions shipped with components shall be delivered to Owner prior to substantial completion.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Store and handle products so as not to impede the work of others.
- B. Protect products from damage or theft during delivery, handling, storage and installation.

PART 2 - PRODUCTS

2.01 MATERIALS

Description	Manufacturer	Model #
1. Curved Bench	LANDSCAPE FORMS	LINK BQ999-06287-1 LINK BQ999-06287-2

Model and manufacturer specified for play structures are school district standard. Substitutions will not be allowed.

Contractor shall purchase touch-up paint for each color of powder coated products for use as needed after installation. Deliver un-used touch-up paint to Owner prior to substantial completion.

PART 3 - EXECUTION

3.01 SEQUENCING AND SCHEDULING:

- A. Coordinate construction timing with installation of site furnishings in conformance with other pertinent Sections of the Specifications.

3.02 INSTALLATION

- A. Site Furnishings: Install where shown on drawings, as detailed and per manufacturer instructions. All site furnishings shall be secured in a vandal resistant manner acceptable to the Architect.
- B. Concrete Footings: Install footings with top of concrete sloped to drain at 1%. Install where shown on drawings and as detailed and per manufacturer's instructions.
- C. Sleeves: Install site furnishings, standards and posts into sleeves embedded into concrete bases for removal and replacement where indicated or detailed on drawings.

3.03 FIELD QUALITY CONTROL

- A. Site furnishings shall be inspected and accepted upon delivery by the Contractor. Final acceptance of site furnishings and locations of site furnishings shall be approved by Owner's Representative in writing.

END OF SECTION

SECTION 21 13 13

WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION

- A. Furnish all materials and labor for the design, installation, and testing of an automatic wet-pipe sprinkler system throughout the Murrieta Public Library.
- B. Authority Having Jurisdiction (AHJ)
 - 1. City of Murrieta.
- C. The contract drawings and this specification are intended to convey the scope of work required and all of which the Contractor is responsible to furnish, install, adjust, and make operable. Where conflicts occur between this specification and the contract drawings, clarification shall be requested. In general, should a conflict occur, this specification will overrule the contract drawings.
- D. All work shall be performed in accordance with these specifications, applicable codes and standards, the design drawings, and good engineering and installation practice. Provide all devices and equipment required by these specifications. Equipment or devices shall not be deleted without written approval of the Owner.
- E. The work performed pursuant to these specifications is to be complete in every respect, resulting in the System installed in accordance with the applicable codes, standards, manufacturers' recommendations, and Underwriters Laboratories Inc. (UL) and/or Factory Mutual (FM) Global approval.

1.02 SUMMARY

- A. Section includes:
 - 1. Pipes, fittings, and specialties.
 - 2. Hangers, seismic bracing, and restraint.
 - 3. Valves.
 - 4. Specialty valves.
 - 5. Sprinklers.
 - 6. Alarm devices.
 - 7. Pressure gauges.
 - 8. Air vent.

1.03 WORK INCLUDED

- A. The scope of work for the Murrieta Public Library Expansion project is to provide an automatic wet-pipe sprinkler system for the new expansion via a new fire water lateral and sprinkler riser.
- B. The automatic wet-pipe sprinkler system shall provide sprinkler coverage throughout the Murrieta Public Library. The system is to be designed and installed in accordance with California Building Code (CBC) and NFPA 13.
- C. Furnish and install all components necessary to result in fully operational and code compliant systems as detailed in this section.
- D. Where impairments to the existing fire sprinkler system are necessary to complete the scope of work, impairment procedures shall be coordinated with the AHJ and Owner in accordance with NFPA 25.
- E. Provide personnel to inspect and verify piping locations as indicated on the contract drawings. The Contractor is responsible for any pipe routing changes, including offsets, required to install the new system.
- F. Submittals: Prepare and submit shop drawings, product data sheets, hydraulic calculations, record drawings, and other submittals required herein.
- G. Tests: Complete all tests required by applicable codes, NFPA standards, Owner requirements, and AHJ requirements.
- H. Approvals and Fees: Contractor shall obtain all approvals from the AHJ and Owner for the work in this section. Contractor shall be responsible for filing all documents, paying all fees, and securing all permits, inspections, and approvals necessary for completing the scope of work in this section.

1.04 RELATED DOCUMENTS AND WORK SPECIFIED ELSEWHERE

- A. FIRE ALARM SYSTEM SPECIFICATIONS, located on the Electrical contract drawings.
- B. Drains: Floor drains and other facilities for receiving discharge from sprinkler system drains.
- C. Alarms: Wiring and connection to sprinkler system alarm and supervisory devices shall be provided by the Fire Alarm Contractor as detailed in the Fire Alarm System Specifications, located on the Electrical contract drawings.

1.05 DEFINITIONS

- A. Standard-Pressure Sprinkler Piping: Fire suppression system piping designed to operate at working pressure of 175-psig maximum.
- B. Underground Service-Entrance Piping: Underground service piping below the building.
- C. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water. The piping is connected to the water supply. Water discharges immediately

from sprinklers when they are opened. Sprinklers open when heat destroys the frangible device or melts the fusible link.

- D. CBC: California Building Code
- E. CFC: California Fire Code
- F. NFPA: National Fire Protection Association

1.06 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Hold all licenses and obtain all permits necessary to perform work of this type in the State of California. Copies of Contractor's licenses shall be provided with bid submittal.
 - 2. Be regularly engaged, for the past five years in the design, installation, testing and servicing of automatic sprinkler systems for buildings of this type.
 - 3. Installer's responsibilities, including designing, fabricating, and installing sprinkler systems.
 - 4. Installer shall be licensed as a C-16 Fire Protection Contractor.
- B. Welding Qualifications: Qualify procedures and operators according to American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code.
- C. Applicable Codes, Standards, and References: All work and materials shall conform to all Federal, State, and local codes and regulations governing this installation, including all parts of Title 24 of the statewide California codes. All work shall conform to the requirements of the applicable editions and portions of the following codes, standards, and references.
 - 1. NFPA 13, "Standard for the Installation of Fire Sprinkler Systems" – 2022 edition
 - 2. NFPA 24, "Standard for the Installation of Private Fire Service Mains and Their Appurtenances – 2019 edition
 - 3. NFPA 25, "Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems – 2013 edition
 - 4. NFPA 72, "National Fire Alarm and Signaling Code – 2022 edition
 - 5. Title 24, Part 2, California Building Code (CBC), 2022 edition
 - 6. Title 24, Part 3, California Electrical Code (CEC), 2022 edition
 - 7. Title 24, Part 5, California Plumbing Code (CPC), 2019 edition
 - 8. Title 24, Part 9, California Fire Code (CFC), 2022 edition

- D. Code Conflicts: Should conflicts exist between the referenced NFPA Standards, Federal, State, or local codes and this specification, Contractor shall bring the conflict to the attention of Owner for resolution. The Contractor shall not attempt to resolve code conflicts with the AHJ, independent of the Owner. In general, in the event of a conflict, the most stringent of the requirements will apply.

1.07 DESIGN REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the CEC, by a qualified testing agency, and marked for intended location and application.
- B. Sprinkler system design shall be approved by the AHJ.
- C. Water Supply: Pipe sizing shall be determined by hydraulic calculations in accordance with NFPA 13 requirements. Hydraulic calculations shall be based upon flow test information obtained from the local jurisdiction or based on a hydrant flow test performed by the contractor.
 - 1. Available hydrant flow request records provided by Western Municipal Water District (Western Water/WMWD) indicate the following water supply information:
 - a. Date: November 18, 2024
 - b. Performed by: Western Municipal Water District (Western Water)
 - c. Location of Flow Hydrant: 8 Town Square; APN 906-080-039/-040; GRID 100050; ID Murrieta; Pressure Zone 1280
 - d. Static Pressure at Residual Hydrant: 65 psi (ground elevation: 1,117 ft.)
 - e. Measured Flow at Flow Hydrant: 1,500 gpm
 - f. Residual Pressure at Residual Hydrant: 59 psi
- D. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers. Hydraulic designs shall incorporate a safety factor of 10 percent of the available water supply pressure at the system demand flow rate.
- E. Sprinkler Occupancy Hazard Classifications
 - 1. Multipurpose Rooms, Office, Vestibule, Family Restroom, Workstations: Light Hazard
 - 2. Workroom, Custodian, Utility Rooms: Ordinary Hazard, Group 1
 - 3. Storage, Children's Stacks: Ordinary Hazard, Group 2
- F. Sprinkler System Design Criteria – Minimum Density
 - 1. Light-Hazard Occupancy: 0.10 gpm over 1,500-sq. ft. area.

2. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1,500-sq. ft. area.
 3. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1,500-sq. ft. area.
 4. The hydraulic most remote area shall be increased by 30 percent if it is under a sloped ceiling with a pitch exceeding 1 in 6 per NFPA 13, 11.2.3.2.4.
 5. The hydraulic most remote area is permitted to be decreased where quick-response sprinklers are used in light hazard areas in accordance with the methods of NFPA 13, Section 11.2.3.2.3.1.
- G. Maximum Protection Area per Sprinkler
1. Maximum protection area based on UL listing and/or NFPA 13.
 2. Light Hazard Areas: 225 sq. ft.
 3. Ordinary Hazard Areas: 130 sq. ft.
 4. Maximum protection areas per extended coverage sprinkler shall comply with NFPA 13 and manufacturer's listed spacing.
 5. Other Areas: According to NFPA 13 recommendations and/or UL listing unless otherwise indicated.
- H. Total Combined Hose-Stream Demand – According to NFPA 13, unless otherwise indicated:
1. Light-Hazard Occupancies: 100 GPM for 30 minutes.
 2. Ordinary-Hazard Occupancies: 250 GPM for 60 minutes.
- I. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.
- J. Sprinkler System Zoning
1. The maximum floor area on any one floor to be protected by sprinklers supplied by any one sprinkler system riser or combined system riser shall be as follows:
 - a. Light Hazard: 52,000 sf
 - b. Ordinary Hazard: 52,000 sf
 - c. Other Areas: Per NFPA 13 unless otherwise indicated.

1.08 ACTION SUBMITTALS

- A. Product Data: For each type of product, including type of pipe, hangers and bracing, valves, pipe fittings/joining methods, sprinklers, waterflow devices, supervisory devices, alarm bell, escutcheons, signage, fire department connection (FDC), and other equipment as applicable.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Specific components on catalog cut sheets must be highlighted or otherwise identified. All equipment drawing alarm or supervisory current shall have documentation of the current draw clearly marked and highlighted in the submittal information.
3. Technical information showing physical dimensions, weight, finish and mounting requirements.
4. All manufacturer's data sheets shall clearly show all UL listing and/or FM approvals for each product submitted.
5. Data sheets shall include, but not be limited to, the following components:
 - a. Sprinklers and accessories
 - b. Pipes, couplings, and fittings
 - c. Check valves
 - d. Gauges
 - e. Alarm flow switches
 - f. Hangers, seismic bracing, restraint, and supports
 - g. Control valves including post indicator valves, gate valves, butterfly valves, and globe valves
 - h. Valve supervisory switches
 - i. Air vents
 - j. Identification signs
 - k. CSFM listing numbers (where available)

B. Shop Drawings

1. Provide working plans prepared in accordance with NFPA 13. Shop drawings shall show all the information required by NFPA 13 and the AHJ for working plans.
2. Calculations: Provide hydraulic calculations and seismic bracing calculations in accordance with NFPA 13.
3. Contractor will be authorized to start portions of the project when the shop drawings for the work are received, reviewed, and approved by the Owner and/or AHJ. Installation or fabrication prior to these approvals shall be at the Contractor's risk.
4. Shop drawings shall include a drawing legend sheet identifying:

- a. All symbols used on the drawings, by type of device or equipment, manufacturer, and manufacturer's part number. This information shall correspond to the manufacturer's catalog data sheets and installation manuals.
 - b. All conventions, abbreviations, and specialized terminology used on the drawings, as necessary to understand and interpret the information contained therein.
 - c. A complete drawing list identifying all drawings in the shop drawing package by title and drawing number.
5. Shop drawings shall include, but not be limited to, the following information:
- a. Hydraulic calculations.
 - b. Complete piping plan for new work and sufficient existing information to substantiate hydraulic calculations.
 - c. Reflected ceiling plan with all areas of work clearly identified.
 - d. Location and size of all new hangers and earthquake bracing.
 - e. Project location.
 - f. Point of compass.
 - g. Ceiling construction.
 - h. Full length cross section.
 - i. Location of fire rated construction, wall partitions, and other obstructions.
 - j. Location of seismic joints in project areas.
 - k. Occupancy hazard classification of each area or room.
 - l. Location and size of blank spaces and closets.
 - m. Identify small enclosures not intended to be provided with sprinkler protection.
 - n. Water supply information – calculate water available from point of connection with water main, upstream of any cross-connection device.
 - o. Other sources of water supply.
 - p. Make, type, number, and nominal orifice size of sprinklers.
 - q. Temperature rating and location of high temperature sprinklers.
 - r. Total area protected by each system on each floor. Number of new sprinklers on each riser per floor.

- s. Nominal pipe size and cutting lengths or center-to-center dimensions of pipe.
 - t. Location and size of riser nipples.
 - u. Type of fittings, joints, sleeves, and location of all welds and bends.
 - v. Location of all control valves, check valves, drain pipes, test pipes, and their terminals.
 - w. Underground pipe size, length, location, weight, material, point of connection to city main, type of valves and meters, and the depth that the top of the pipe is laid below grade.
 - x. Provisions for flushing – size all drains and test valves to handle maximum water volume.
 - y. Complete hydraulic name-plate data.
 - z. Name and address of Contractor, California State Contractor's license stamp, and identity of the designer.
 - aa. Mounting height of fire department connections.
 - bb. UL listed through-penetration firestop system for penetrations of rated assemblies.
 - cc. Edition year of NFPA 13 to which the sprinkler system is designed.
- C. Hydraulic Calculations
- 1. Hydraulic calculations shall be provided in a separate document from the product data submittal and sprinkler drawings.
 - 2. All hydraulically designed sprinkler systems shall be provided with a minimum of a ten percent safety margin on the pressure side of the design graph.
 - 3. All sprinkler systems shall be designed to provide the appropriate density based upon a hazard occupancy classification specified by NFPA 13. In those cases where NFPA 13 does not specifically identify the hazard occupancy classification, the AHJ shall determine the hazard classification.
- D. Seismic Bracing Calculations shall be provided in accordance with NFPA 13. Identify the zone of influence associated with the calculations on the shop drawings.

1.09 INFORMATIONALSUBMITTALS

- A. Coordination Drawings: Sprinkler systems, or BIM model, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved.
- B. Qualification Data: For qualified Installer.

- C. Welding certificates.
- D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- E. Field quality-control reports.

1.10 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire suppression systems and specialties to include in emergency, operation, and maintenance manuals.
 - 1. Manufacturer's catalog data sheets and installation manuals.
 - 2. Copy of NFPA 25 inspection, testing, and maintenance procedures, with applicable amendments.
 - 3. Copy of all test certificates and approvals.
 - 4. A list of recommended spare parts and summary of spare parts provided.
 - 5. A service directory, including a list of Contractor's contact names and telephone numbers for service on the system, including emergency service as required elsewhere in these specifications.
- B. Upon completion of this work, and as a part of this contract, Contractor shall provide Owner with:
 - 1. Complete information and "as-built" record drawings describing and depicting the entire system as installed, including all information necessary for maintaining, troubleshooting, and/or expanding the system at a future date.
 - 2. Complete documentation of system testing and AHJ acceptance.
 - 3. Certification that the Contractor's work has been inspected and tested, is installed entirely in accordance with the applicable codes, standards, manufacturers' recommendations and UL listings and/or FM approvals, and is in proper working order. Contractor shall use "Contractor's Material and Test Certificate(s)" as required by NFPA codes.

1.11 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinkler plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on the project.

- B. Spare parts and special tools shall be provided to Owner prior to final acceptance and shall be provided for each system riser location.

1.12 WARRANTY AND EMERGENCY SERVICE

- A. Contractor shall warranty all materials and workmanship for a period of one (1) year beginning with the date of final acceptance of the Contractor's completed installation by the Owner. Contractor shall be responsible during the design, installation, testing and warranty periods for any damage caused by the Contractor (or its subcontractors) or by defects in the Contractor's (or its subcontractors') work, materials, or equipment.
- B. Emergency Service: During the installation and warranty period, the Contractor shall provide emergency repair service for the sprinkler system within four (4) hours of a request by Owner for such service. This service shall be provided on a 24-hour per day, seven days per week basis.

1.13 Field Conditions

- A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:
 - 1. Notify the Owner and/or AHJ no fewer than five (5) days in advance of proposed interruption of sprinkler service.
 - 2. Do not proceed with interruption of sprinkler service without written permission from the Owner and/or AHJ.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Equipment: All devices, systems, equipment, and materials furnished and installed shall be new and shall be submitted for approval by the Owner. All sprinklers, pipe, fittings, hangers, valves, and other materials and other equipment shall be UL Listed and/or FM approved for their intended use. All equipment shall be acceptable to the AHJ and listed with the California State Fire Marshal when listings of acceptable equipment are available.
- B. Where the Contractor substitutes products and materials from those identified in the contract documents or specifications, the Contractor shall be responsible for additional work and all fees associated with these changes, with no additional cost to the Owner. No substitution of products and materials (piping, sprinklers, hangers, fittings, etc.) shall be made from those identified in the AHJ approved permit drawings unless expressed written approval is obtained from the Owner and AHJ.

2.2 STEEL PIPE AND FITTINGS

- A. Standard-piping system component working pressure: Listed for minimum 175 psig.

- B. Threaded-End, Schedule 40, Black-Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795. Pipe ends may be factory or field formed threaded ends.
 - 1. Cast-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
 - 2. Steel Couplings: ASTM A 865/A 865M, threaded.
 - 3. Steel Threaded Pipe Nipples – ASTM A 53/A 53M, Schedule 40 steel pipe, hot-dip galvanized where indicated. Include ends matching joining method.
- C. Grooved-End, Schedule 40, Black-Steel Pipe: ASTM A53/A 53M, ASTM A 135, or ASTM A 795. Pipe ends may be factory or field formed, square-cut- or rolled- grooved ends.
 - 1. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
 - 2. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, rubber gasket listed for use with housing, and steel bolts and nuts.
- D. Schedule 40, Stainless Steel Pipe: Standard Weight stainless steel conforming to ASTM A312/A312M, Grade TP304L. Fittings may include SS screwed fittings, grooved fittings, or welded.
 - 1. Seamless socket weld type or flanged type fitting shall conform to ASTM A403/A403M, Grade WP 304L, and shall be compatible with the pipe.
 - 2. Grooved type fittings and couplings shall be Type 316 Stainless Steel conforming to ASTM A351/A351M.
- E. Schedule 10, Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M, Schedule 10 in NPS 5 (DN 125) and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10 (DN 150 to DN 250). Pipe ends may be factory or field formed, rolled- grooved ends.
- F. Schedule 40 piping must be used for piping less than 2 1/2-inches in diameter. Schedule 10 piping is permitted for piping of 2 1/2-inches in diameter and larger.
- G. Uncoated-Steel Couplings: ASTM A865/A865M, threaded.
- H. Uncoated, Cast-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- I. Malleable Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
- J. Malleable- or Ductile-Iron Unions: UL 860.
- K. Cast-Iron Flanges: ASME 16.1, Class 125.
- L. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick, ASME B16.21, nonmetallic and asbestos free, or EPDM rubber gasket.
 - a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
 - b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
 2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.
- M. Grooved-Joint, Steel-Pipe Appurtenances
1. Pressure Rating: 175-psig minimum.
 2. Uncoated Grooved-End Fitting for Steel Piping: ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.
 3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.
- N. Steel pipe shall be joined by means of flanges screwed to the pipe, threaded fittings, or grooved couplings only. Mechanical fastened tees shall not be used in new systems unless approved by the building owner and the AHJ.
- O. Pressure seal type fittings or methods of joining pipe as well as plain-end fittings are not acceptable. Reductions in pipe sizes shall be made with one-piece reducing fittings. Bushings are not acceptable.

2.3 PIPING SCHEDULE

- A. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- B. Galvanized pipe shall be used for drain pipe.
- C. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with:
 1. Threaded ends, cast-iron threaded fittings, and threaded joints.
 2. Grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.
- D. Standard-pressure, fire suppression system, NPS 2 and smaller shall be one of the following:
 1. Schedule 40 black-steel pipe with threaded ends; uncoated, cast-iron threaded fittings; and threaded joints.
 2. Schedule 40 black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end pipe couplings for steel piping; and grooved joints.

3. Schedule 40 black-steel pipe with plain ends; steel welding fittings; and welded joints.
- E. Standard-pressure, fire suppression system, NPS 2-1/2 and larger, shall be one of the following:
 1. Schedule 40 or greater black-steel pipe with threaded ends; uncoated, cast-iron threaded fittings; and threaded joints.
 2. Schedule 10 or greater black-steel pipe with cut- or rolled-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 3. Schedule 40 black steel-pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 4. Schedule 10 or greater back-steel pipe with plain ends; steel welding fittings; and welded joints.

2.4 VALVES

- A. All valves must be UL listed, FM approved, and/or California State Fire Marshal approved for their intended use. Valves shall be manufactured by companies with a full line of fire protection system components.
- B. Pressure Rating: All valves shall meet or exceed the maximum working pressures available within the system.
- C. Body Material: Bronze, cast, or ductile iron.
- D. Size: Same as connected piping.
- E. End Connections: Flanged or grooved.
- F. Ball Valves
 1. NPS 1-1/2 and Smaller: Bronze body with threaded ends.
 2. NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
 3. NPS 3: Ductile-iron body with grooved ends.
- G. Butterfly Valves
 1. NPS 2 and Smaller: Bronze body with threaded ends.
 2. NPS 2-1/2 and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends.
- H. Check Valves

1. NPS 2 and Larger: Swing type, cast-iron body with flanged or grooved ends.

I. OS&Y Type Gate Valves

1. NPS 2 and Smaller: Bronze body with threaded ends.
2. NPS 2-1/2 and Larger: Cast-iron body with flanged ends.

J. Indicating Valves

1. Includes integral indicating device and ends matching connecting piping.
2. Indicator: Electrical, 115-V ac, prewired, 2-circuit, supervisory switch.
3. NPS 2 and Smaller: Ball or butterfly valve with bronze body and threaded ends.
4. NPS 2-1/2 and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.

K. Automatic (Ball Drip) Drain Valves

1. Standard: UL 1726.
2. Pressure Rating: 175-psig minimum.
3. Type: automatic draining, ball check.
4. Size: NPS 3/4 (DN 20).
5. End Connections: Threaded.

L. Other Valves

1. Ball Valves NPS 2 and Smaller: MSS SP-110, 2-piece copper-alloy body with chrome-plated brass ball, 600- psig minimum CWP rating, blowout-proof stem, and threaded ends.
2. Check Valves NPS 2 and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.
3. Gate Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge and threaded ends.
4. Globe Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.5 AIR VENT

A. Manual Air Vent/Valve

1. Description: Ball valve that requires human intervention to vent air.
2. Body: Forged brass.

3. Ends: Threaded.
4. Minimize Size: 1/2 inch.
5. Minimum Water Working Pressure Rating: 175 psig.

B. Automatic Air Vent

1. Description: Automatic air vent that automatically vents trapped air without human intervention.
2. Standard: UL listed or FM Global approval for use in wet-pipe fire sprinkler systems.
3. Vents oxygen continuously from system.
4. Float valve to prevent water discharge.
5. Minimum Water Working Pressure Rating: 175 psig.

C. Automatic Air Vent Assembly

1. Description: Automatic dual air vent assembly that automatically vents trapped air without human intervention, including Y-strainer and ball valve in a pre-piped assembly.
2. Standard: UL listed or FM Global approved for use in wet-pipe fire sprinkler system.
3. Vents oxygen continuously from system.
4. Float valve to prevent water discharge.
5. Minimum Water Working Pressure Rating: 175 psig.

2.6 SPRINKLER PIPING SPECIALTIES

- A.** Sprinkler specialty fittings shall be UL listed or FM approved, with 175-psig minimum working-pressure rating, and made of materials compatible with piping. Sprinkler specialty fittings shall have minimum 250-psig minimum working-pressure rating if fittings are components of high-pressure piping system.

B. Flow Detection and Test Assemblies

1. Pressure Rating: 175-psig minimum.
2. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
3. Size: Same as connected piping.
4. Inlet and Outlet: Threaded or grooved.

C. Sprinkler Inspector's Test Fittings

1. Pressure Rating: 175-psig minimum.
2. Body Material: Cast- or ductile-iron housing with sight glass.
3. Size: Same as connected piping.
4. Inlet and Outlet: Threaded.

D. Adjustable Drop Nipples

1. Standard: UL 1474.
2. Pressure Rating: 250-psig minimum.
3. Body Material: Steel pipe with EPDM-rubber O-ring seals.
4. Size: Same as connected piping.
5. Length: Adjustable.
6. Inlet and Outlet: Threaded.

E. Flexible Sprinkler Hose Fittings

1. Standard: UL 1474.
2. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid. Materials shall be suitable for system fluid.
3. Pressure Rating: 175-psig minimum.
4. Size: Same as connected piping, for sprinkler.
5. NPS 2 and Smaller: Threaded.
6. NPS 2-1/2 and Larger: Flanged.
7. Option for NPS 2-1/2 and Larger: Grooved for use with grooved-end-pipe couplings.
8. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.
9. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.
10. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

2.7 FLEXIBLE CONNECTORS

- A. Flexible connectors shall have materials suitable for system fluid. Include 175-psig minimum working-pressure rating and ends according to the following:
 - 1. NPS 2 and Smaller: Threaded.
 - 2. NPS 2-1/2 and Larger: Flanged.
 - 3. Option for NPS 2-1/2 and Larger: Grooved for use with grooved-end-pipe couplings.
 - 4. Standard: UL 1474.
 - 5. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
 - 6. Pressure Rating: 175-psig minimum.
 - 7. Size: Same as connected piping, for sprinkler.
- B. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.
- C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.
- D. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

2.8 ELECTRICAL WORK

- A. Furnish all labor, equipment, and services necessary for the design and the installation of the electrical wiring of connections as required to complete a fully operational system. Contractor will be responsible for the mounting of all water flow and tamper switches for the fire protection system in this specification. Wiring of such devices is outside the scope of this specification. Wiring of such devices is included in the FIRE ALARM SYSTEM SPECIFICATIONS, located on the Electrical contract drawings, and is the responsibility of the fire alarm contractor.

2.9 SPRINKLERS

- A. Sprinklers shall be UL listed and/or FM approved, with 175-psig minimum pressure rating.
- B. Pressure Rating for Automatic Sprinklers: 175-psig minimum.
- C. Automatic Sprinklers with Heat-Responsive Element
 - 1. Nonresidential Applications: UL 199

- D. Sprinkler Orifice: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6 unless otherwise indicated or required by application in accordance with NFPA 13. Sprinkler orifice shall conform to NFPA 13 for the application the sprinkler is used for.
- E. Sprinkler types, features, and options, subject to Architect's and Owner's approval, as follows:
 - 1. Concealed ceiling sprinklers, including cover plate
 - 2. Recessed or Semi-Recessed ceiling sprinklers, including escutcheon
 - 3. Pendent sprinklers
 - 4. Quick-response sprinklers
 - 5. Sidewall sprinklers
 - 6. Upright sprinklers
- F. Temperature Rating
 - 1. Install sprinklers of the proper temperature rating as required by NFPA 13.
 - 2. Within the Electrical Rooms, install intermediate temperature sprinklers.
- G. Sprinkler Finishes: Chrome plated, bronze and/or painted.
- H. Corrosion Resistance: Sprinklers located on exterior piping systems, in areas exposed to the exterior, or in areas exposed to corrosive atmospheres shall be UL listed and/or FM approved corrosion resistant sprinklers.
 - 1. Wax coated
 - 2. Polyester Finish
 - 3. ENT/Electroless Nickel PFTE
 - 4. Stainless Steel
 - 5. Corrosion resistant coatings shall be part of the sprinkler listing.
- I. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications.
 - 1. Escutcheons for concealed and recessed-type sprinklers are specified with sprinklers.
 - 2. Recessed Mounting: Chrome-plated steel, two-piece, recessed.
 - 3. Sidewall Mounting: Chrome-plated steel, two-piece, recessed.
- J. Sprinkler Guards

1. Standard: UL 199.
2. Type: Wire cage with fastening device for attaching to sprinkler.

2.10 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
1. Rooms without Ceilings: Upright sprinklers.
 2. Rooms with Suspended Ceilings: Concealed, recessed, or semi-recessed pendent sprinklers.
 3. Spaces Subject to Freezing: Pendent, dry sprinklers; Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as indicated.
 4. Wall Mounting: Sidewall sprinklers.
 5. Special Applications: Attic sprinklers, Combustible concealed space sprinklers.
 6. IT/Electrical Rooms: Sidewall sprinklers or extended coverage sidewall sprinklers preferred to minimize system piping within room, where allowed by room arrangement. Sprinklers to be listed to protect Ordinary Hazard occupancy classification.
 7. Corrosion Resistance: Sprinklers located on exterior piping systems or in areas exposed to corrosive atmospheres shall be UL listed and/or FM approved corrosion resistant coated or stainless steel.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
 2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
 3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
 4. Upright, Pendent, and Sidewall Sprinklers: Chrome-plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.
- C. Provide quick-response sprinklers throughout, unless noted otherwise, and in accordance with NFPA 13 and CBC requirements.

2.11 FIRE-DEPARTMENT CONNECTION

- A. Yard-Type Fire Department Connection
1. Standard: UL 405.
 2. Type: Exposed, freestanding.
 3. Pressure Rating: 300 psig minimum.

4. Body Material: Corrosion-resistant metal.
5. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
6. Caps: Brass, lugged type, with gasket and chain.
7. Escutcheon Plate: Round, brass, floor type.
8. Outlet: Bottom, with pipe threads.
9. Number of Inlets: Two.
10. Sleeve: Polished chrome-plated, Rough brass or bronze, or Rough chrome-plated.
11. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE".
12. Finish: Polished chrome-plated, Rough brass or bronze, or Rough chrome-plated.
13. Outlet Size: NPS 6 (DN 150).

2.12 BACKFLOW PREVENTER

A. Double-Check Detector Assembly Backflow Preventer:

1. Standard: UL 312 and ASSE 1048
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 5 psig maximum, through middle one-third of flow range.
4. Size: NPS 6 (DN 150)
5. Design Flow Rate: 1,000 gpm
6. Body Material: Cast iron with interior lining complying with AWWA C550 or that is FDA approved; Steel with interior lining complying with AWWA C550 or that is FDA approved; Stainless steel.
7. End Connections: Flanged.
8. Configuration: Designed for vertical inlet, horizontal center section, and vertical outlet flow.
9. Accessories:
 - a. Valves: UL 262 and FM Global's "Approval Guide" listing; OS&Y gate type with flanged ends on inlet and outlet.
 - b. Bypass: With displacement-type water meter and shutoff valves.

2.13 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Electrically Operated Notification Appliances
 - 1. Electric Bell
 - a. Standard: UL 464.
 - b. Type: Vibrating, metal alarm bell.
 - c. Size: 6-inch minimum diameter.
 - d. Voltage: 120 V ac, 60 Hz, 1 phase or 24 V dc.
 - e. Finish: Red-enamel or polyester powder-coat factory finish, suitable for outdoor use with approved and listed weatherproof backbox.
 - 2. Strobe/Horn
 - a. Standard: UL 464.
 - b. Tone: Selectable, steady, Temporal-3 (T-3) in accordance with ISO 8201 and ANSI/ASA S3.41, 2400 Hz, electromechanical, broadband.
 - c. Voltage: 120 V ac, 60 Hz.
 - d. Effective Intensity: 110 cd.
 - e. Finish: Red, suitable for outdoor use with approved and listed weatherproof backbox. White letters on housing identifying device as for "Fire".
 - f. Sign, Integrated: Mount between backbox and strobe/horn with text visible on both sides, above and below strobe/horn. Housing to be shaped to cover surface-mounted weatherproof backbox. Sign is to consist of white lettering on red plastic identifying it as a "Sprinkler Fire Alarm" and instructing viewers to call 911, police, or fire department.
- C. Waterflow Switches: Vane-type and/or pressure-type water flow indicators shall be provided to indicate waterflow in each sprinkler system zone and shall be UL listed and/or FM approved. All water flow switches shall be equipped with an adjustable retard setting that can be varied from 0 to at least 60 (minimum) seconds.
- D. Water-Flow Indicators
 - 1. Standard: UL 346.
 - 2. Water-Flow Detector: Electrically supervised.
 - 3. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-

set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.

4. Type: Paddle operated.
5. Pressure Rating: 250 psig.
6. Design Installation: Horizontal or vertical.

E. Waterflow Pressure Switches

1. Standard: UL 346.
2. Type: Electrically supervised water-flow switch with retard feature.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design Operation: Rising pressure signals water flow.

F. Valve Supervisory Switches

1. Standard: UL 346.
2. Type: Electrically supervised.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design: Signals that controlled valve is in other than fully open position.
5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Loop Type Valve Supervisory Switches: Contractor shall not use wire loop type switches.

2.14 SLEEVES AND ESCUTCHEONS

A. Sleeves

1. Sleeves through structural concrete members and sleeves for walls below grade and floors on grade shall be standard weight galvanized Schedule 40 steel pipe.
2. Sleeves through other than structural components of the building shall be 20 gage galvanized sheet metal with lock seam joints.
3. Sleeves set in walls and slabs with waterproof membrane may be either cast iron or steel and shall be provided with a flashing clamp device and corrosion resistance clamping bolts.
4. Sleeves in floors on grade or exterior wall below grade shall be packed with oakum between pipe and sleeve, flush with top of sleeve for floors and with outer surface for walls.

5. Sleeves at seismic or expansion joints shall not be packed unless located in a fire wall where piping is routed through fire walls which are seismic or expansion joints. Approved swing joints shall be used, and the sleeves appropriately packed as specified above.

- B. Pipe escutcheon plates to be installed where exposed piping passes through walls, ceilings, and floors of building shall be minimum 20 gage steel, chrome.

2.15 HANGERS AND BRACING

- A. Pipe hangers and supports shall be UL listed and/or FM approved and shall be the adjustable type. Installation shall be according to the manufacturer' listing and NFPA 13.
- B. Seismic hangers, bracing, and restraint shall be UL listed and/or FM approved for fire protection use and shall be installed in accordance with their listings and manufacturers' recommendations. Type, quantity, and spacing shall be in accordance with the requirements for the specific seismic zone requirements and those of NFPA 13.
- C. Piping material and hanger material shall not be of dissimilar materials.
- D. Hanger rods of less than 3/8-inch diameter are not permitted.
- E. All beam clamps shall be fitted with steel retainer straps.
- F. Corrosion protection: All hangers and supports, where exposed to the weather or installed in a corrosive atmosphere, shall be protected against corrosion. Corrosion-resistant materials or protective corrosion-resistant coatings shall be used.

2.16 IDENTIFICATION SIGNS

- A. Identification signs shall be rigid, metal plaques with embossed enamel background and lettering. Signs shall be secured by chain or durable wire to each sprinkler zone control valve, main and auxiliary drain, and inspector's test valve. System hydraulic calculation placards affixed using adhesives, and/or using permanent marker for information, are NOT acceptable.

2.17 MISCELLANEOUS PRODUCTS

- A. Pressure Gages
 1. Standard: UL 393.
 2. Dial Size: 3-1/2- to 4-1/2-inch diameter.
 3. Pressure Gage Range: 0- to 250-psig minimum.
 - a. Label: Include "WATER" or "AIR/WATER" label on dial face.
 - b. Air System Piping Gage: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Obtain water supply information from the Owner and/or local jurisdiction.
 - 1. For the City of Murrieta, obtain water supply information from Western Municipal Water District (aka Western Water).
- B. Verify all conditions of the water supply and fire service piping that supplies the fire suppression system.

3.2 EXAMINATION

- A. Examine incoming fire service and point of connection.

3.3 JOB CONDITIONS

- A. Damage: Protect all unfinished work to prevent damage and furnish protection of all surrounding areas where necessary.
- B. Leak Damage: The Contractor shall be responsible during the installation and testing periods of the sprinkler system for any damage to the work of others, to the building or its contents caused by leaks in any equipment, by unplugged or disconnected pipes or fittings, or by overflow, and shall pay for the necessary replacements or repairs to work of others damaged by such leakage.

3.4 SERVICE-ENTRANCE PIPING

- A. Connect sprinkler piping to water-service piping for service entrance to building.
- B. Install shutoff valve, pressure gauge, drain, and other accessories indicated at connection to water-service piping.
- C. Connect fire sprinkler system piping to water-service piping for service entrance to building.

3.5 GENERAL INSTALLATION

- A. Aesthetics shall be a primary consideration when installing sprinklers and sprinkler piping in all areas. Any facet of sprinkler installation that deviates from the approved shop drawings and does not meet with Owner's approval shall be revised by Contractor to Owner's satisfaction at no additional cost.
- B. All holes made by the Contractor in any wall, ceiling, or floor shall be patched by the Contractor, restoring the wall, ceiling, floor or member to its original condition, fire resistance, and integrity.
- C. Location of all equipment, controls, piping, valves and drains shall be subject to Owner's approval.

- D. Deviations from approved working plans require written approval from authorities having jurisdiction. File written approval with the Architect before deviating from approved working plans.
- E. Protection: Contractor shall provide the Owner approved, adequate permanent protection for any installed piping, valves, devices, or accessories which, in Owner's opinion, are subject to physical damage or may be hazardous.

3.6 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with the Architect before deviating from approved working plans.
 - 2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
- C. Corrosion protection: All piping and hangers, where exposed to the weather or installed in a corrosive atmosphere, shall be protected against corrosion. Corrosion-resistant types of pipe, fittings, and hangers or protective corrosion-resistant coatings shall be used.
- D. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.
- E. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage. Coordinate locations of sprinkler piping with drains.
- H. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- I. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
- J. Install alarm devices in piping systems.

- K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- L. Install pressure gauges where required by applicable NFPA standards. Install pressure gauges on riser or feed main and at each sprinkler test connection in accordance with the applicable NFPA standard. Include pressure gauges with connection not less than NPS 1/4 (DN 8) and with soft-metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and install where they are not subject to freezing.
- M. Fill wet-pipe sprinkler system piping with water.
- N. Install sleeves for piping penetrations of walls, ceilings, and floors. Install sleeve seals for piping penetrations of concrete walls and slabs. Install escutcheons for piping penetrations of walls, ceilings, and floors.
 - 1. Sleeve shall extend three inches past floors and shall be flush with walls, ceilings, and partitions.
 - 2. In concrete construction, sleeves shall be set in forms prior to pour.
 - 3. Fire-rated walls and floors: Caulk space between pipe and sleeve with flexible, approved fire-resistive packing compound to achieve rating at least equal to that of the wall or floor penetrated and in accordance with UL firestopping system.
 - 4. Sleeves in floors on grade or exterior wall below grade shall be packed with oakum between pipe and sleeve, flush with top of sleeve for floors and with outer surface for walls.
 - 5. Sleeves at seismic or expansion joints shall not be packed unless located in a fire wall where piping is routed through fire walls which are seismic or expansion joints. Approved swing joints shall be used, and the sleeves appropriately packed as specified above.
 - 6. Sleeve Clearance: Clearance between sleeves and pipes shall be 1-inch for pipes through 3 1/2-inch, 2-inch for pipe sizes 4-inches and greater, and three inches for seismic joints.
 - 7. Shop weld pipe joints where welded piping is indicated.
- O. Shop weld pipe joints where welded piping is indicated.
- P. All branch line piping shall be minimum 1-inch nominal size. Branch line piping in gridded systems shall be minimum 1 1/4-inch nominal size. Threaded outlets on branch lines supplying sprinklers shall match the sprinkler heads, but shall be 1-inch NPT if supplying a sprig or drop.
- Q. Pipe Routing: Sprinkler piping shall not be run through electrical rooms, IT or telecom rooms, or elevator equipment spaces unless piping is serving those spaces. Pipe routing shall be coordinated to avoid installation of sprinkler piping directly above electrical equipment. If pipe routing over equipment is unavoidable, the Contractor

shall provide drain pans under piping to prevent leaking pipe drips from damaging equipment while maintaining sprinkler coverage.

- R. All sprinkler piping installed in public areas or non-public areas with suspended ceilings shall be concealed in the walls, ceilings, or soffits. Pipe in unfinished areas may be exposed.
- S. Minimum Height: All exposed piping and devices shall be installed as high as possible, but no less than seven (7) feet clear above the finished floor in traffic or working areas, so as not to obstruct any portion of a window, doorway, stairway, or passageway. Pipe and fittings shall not interfere with the operation or accessibility of any mechanical, plumbing, or electrical equipment.
- T. Fire-stopping: Pipe that passes through fire-rated resistive barriers (including shaft walls) shall be protected by a UL listed through-penetration fire-stop system in accordance with the California Building Code to maintain the integrity and rating of the fire resistive barrier. The materials used to seal penetrations shall be compatible with the piping material.

3.7 JOINT CONSTRUCTION

- A. Pressure ratings: Pressure ratings of all fittings shall meet or exceed maximum working pressures available within the system.
- B. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- C. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
- D. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
- E. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- F. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- G. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- H. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

- I. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
 - 1. Shop weld pipe joints where welding piping is indicated. Do not use welded joints for galvanized-steel pipe.
- J. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- K. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble couplings with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- L. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.8 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and the AHJ.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating the portion of system controlled by each valve.
- C. Install listed fire-protection isolation control valves at each standpipe riser. Valves shall be supervised in the open position.
- D. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- E. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- F. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- G. Examine threads on valve and mating pipe for form and cleanliness.
- H. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- I. Do not attempt to repair defective valves; replace with new valves.
- J. Specialty Valves
 - 1. Install valves in vertical position for proper direction of flow, in main supply to system.

2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.

K. Air Vent

1. Provide at least one air vent at high point in each wet-pipe sprinkler system in accordance with NFPA 13 requirements. Connect vent into top of fire sprinkler piping.
2. Provide dielectric union for dissimilar metals, ball valve, and strainer upstream of automatic air vent.
3. Pipe from outlet of air vent to drain.

L. Relief Valves: For all wet pipe systems, provide a relief valve not less than 1/2-inch size and set to operate at 175 psi or 10 psi in excess of the maximum system pressure, whichever is greater. Location of relief valves to be in accordance with NFPA 13.

M. Access: Control valves shall be located in accessible spaces. Contractor shall furnish and install access panels (minimum size 12-inches by 12-inches) for all control valves concealed in walls. Valves controlling water supply to the sprinkler systems shall be less than seven (7) feet above the finished floor. When specifically approved by the Owner, the control valves may be located at a higher elevation, but they must be provided with operating chains. Control valves more than 7-feet above the finished floor shall be provided with a means of opening and closing the valve from floor level per the California Building Code Chapter 35's amendment to NFPA 13. Owner will select the finish of the access panels. Access panels installed in fire resistive construction shall be of the types required for maintaining proper protection of assembly.

N. Valves and assemblies that are exposed to potential damage by vehicles or other traffic are to be protected by providing a cage or other approved barrier when located inside the building.

O. Supervision: All system control valves shall be capable of being locked in the open position. Valve supervisory switches shall be provided on all valves controlling water supply to the fire sprinkler system, including valves located at backflow preventers. All supervisory switches shall be electrically supervised by the building fire alarm system.

3.9 SPRINKLER INSTALLATION

- A. **Sprinklers under ducts (or other):** Provide sprinklers under ducts, stairs, and other obstructions as required by NFPA 13.
- B. **Uniformity:** All sprinklers within a space shall be from the same manufacturer and shall have the same type and style of heat response element, including temperature rating and response characteristics.
- C. **Install sprinklers** of the proper temperature rating as required by NFPA 13 and the Owner's requirements.

- D. All sprinklers shall be installed in center of tile in areas with 2-feet x 2-feet suspended ceiling tiles, plus or minus 1-inch. Sprinklers shall be installed in quarter or center of tile in areas with 2-feet x 4-feet suspended ceiling tiles, plus or minus 1-inch. Coordinate location of all sprinklers in finished areas with the Architect and/or Owner. Sprinklers should be aligned in all directions when multiple sprinklers are in the same area and are in the same line of sight.
- E. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.
- F. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.
- G. All sprinklers and equipment shall be installed in accordance with manufacturers' instructions. All special tools recommended by the manufacturer shall be used, including sprinkler wrenches.
- H. Sprinklers in concealed combustible spaces: Provide sprinkler protection in concealed spaces of combustible construction as required by NFPA 13.
- I. Sprinklers shall be installed with the deflector to ceiling distances in accordance with their UL listings and/or FM approval and the requirements of NFPA 13. Provide sprig-ups when necessary to comply with deflector distance requirements of NFPA 13.
- J. Sprinkler guards shall be installed on any sprinklers within 7-feet of finished floor or when sprinklers may be subject to mechanical damage. Install guards for sprinklers located within IT and Electrical Rooms. Sprinkler guards shall be UL listed. Fusible link style sprinklers shall be acceptable in areas subject to damage. Sprinkler finish in such areas shall be brass, unless otherwise directed by the Owner in the submittal process.

3.10 FIRE DEPARTMENT CONNECTION

- A. Install fire-department connection (FDC) downstream of backflow preventer. FDC may be either yard mounted or located on the backflow prevention assembly. Install yard-type fire-department connections in concrete slab support.
- B. Locate FDC on address side of the building, fully visible from the street or nearest point of fire department vehicle access.
- C. Maintain 36-inch clear space around the FDC, provided to a height of 78-inches.
- D. Fences, bushes, trees, walls, and other fixed or movable obstructions shall not impair access to the FDC.
- E. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to a spill-over floor drain or to outside of the building.

3.11 BACKFLOW PREVENTER INSTALLATION

- A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of the Public Health Department and AHJ.
- B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.
- C. Do not install bypass piping around backflow preventers.
- D. Support NPS 2-1/2 (DN 65) and larger backflow preventers and piping on concrete piers.

3.12 SYSTEM TEST AND DRAIN CONNECTIONS

- A. Contractor shall provide all test valves and drain connections as required by NFPA 13.
- B. Install sprinkler piping with drains in accordance with NFPA 13 for complete system drainage.
- C. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- D. All test connections and drain riser connections shall be hard piped to discharge wastewater to building's sanitary sewer system. The sewer system shall accommodate the full flow for the main drain. Coordinate routing of the drain pipe and points of discharge with the AHJ and Owner requirements.
- E. Pipe all inspector's test connections discharging to atmosphere to location where water drained will not damage stock, equipment, vehicles, planted areas, etc. or injure personnel.
- F. Provide splash blocks where inspector's test discharge could damage surroundings.
- G. Provide 1-inch sight glass if inspector's test discharge cannot be steadily observed while operating valve.
- H. All pipe and fittings downstream of inspector's test valve shall be galvanized.

3.13 HANGERS, SUPPORT, AND BRACING

- A. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- B. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.
- C. All flexible couplings, hangers, sway bracing, and branch line restraint shall be designed and installed as required by NFPA 13 and in accordance with their listings and/or approvals. Flexibility, internal pressure, and differential movement between the piping and building, earth, or other supporting structure shall be allowed for so that no allowable stress is exceeded in any member.

- D. A seismic separation assembly shall be installed where sprinkler piping crosses a building's seismic separation joints.
- E. Non-sprinkler materials are prohibited from being suspended from or attached to sprinkler piping or components.

3.14 ELECTRICAL WORK

- A. Furnish all labor, equipment, and services necessary for the design and installation of the electrical wiring of connections as required to complete a fully operational system. Contractor will be responsible for the mounting of all water flow and tamper switches for the fire protection system in this specification. Wiring of such devices is outside the scope of this specification. Wiring of such devices is included in the FIRE ALARM SYSTEM SPECIFICATIONS, located on the Electrical contract drawings, and is the responsibility of the fire alarm contractor.
- B. Service. Confirm power connections with the electrical contractor.
- C. Testing. Provide the required assistance to the fire alarm contractor to test, adjust, and place the fire protection system into initial operation.

3.15 IDENTIFICATION

- A. Signs: All water supply control valves and drain valves shall be marked with metal signs and shall be secured with metal chains or other means approved by the Owner and AHJ to show their function and sprinkler system zone that they serve. Attachment of signs to the valves with adhesives is not permitted. Access and signage shall be obvious, and visibility of signage shall not be blocked by equipment.
- B. Hydraulic calculation signs shall include all information indicated in NFPA 13 and its appendices.
- C. Identify system components, wiring, cabling, and terminals.

3.16 FLUSHING AND SANITIZATION

- A. All equipment and materials prior to installation shall be clean inside and outside. All waste material such as chips, filings, welding stubs, dirt, rags, debris, and any other foreign material shall be removed from the components before assembly.
- B. All steel pipe coupons or punched holes for welded outlets shall be attached to the pipe near the pipe hole. Protective plastic caps shall be located over openings and pipe ends during installation to prevent foreign material from entering the pipe at any time.
- C. Testing: All piping is to be flushed and hydraulically tested prior to acceptance by the Owner. Flushing and testing must be performed in accordance with NFPA standards.
- D. Contractor shall provide all equipment necessary for testing and flushing, and any special equipment required for the installation of any portion of the sprinkler system. Contractor shall remove all such equipment at the end of the job.

3.17 FIELD QUALITY CONTROL

- A. Coordinate the installation schedule for this portion of the work with the overall construction schedule for the project to ensure orderly progress of the work without delay.
- B. Coordinate the interface of the fire suppression systems with the work of all other trades as well as new construction to ensure proper and adequate provision for the installation and connection of this system.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" chapter.
 - 4. Energize circuits to electrical equipment and devices.
 - 5. Coordinate with fire-alarm tests. Operate as required.
- D. Sprinkler system will be considered defective if it does not pass tests and inspections.
- E. Perform field test and inspections, and prepare test reports.

3.18 FINAL INSPECTIONS AND TESTING

- A. Contractor shall make arrangements with the Owner for the Owner's final inspection and witnessing of the final acceptance tests. This test shall be separate from testing by the local authorities.
- B. All tests and inspections required by the referenced codes and standards, AHJ, and Owner shall be conducted by the Contractor per the following scope of work:
 - 1. When the AHJ is required to witness tests, the Contractor shall be responsible for making all necessary arrangements with the code authorities and coordinating testing with the Owner.
 - 2. Contractor shall be responsible for completing all test documents with necessary approval stamps and signatures of the AHJ. Contractor shall submit three (3) copies of each of these documents to the Owner for their records.
- C. Acceptance Testing: Upon completion of each system, perform and document on an NFPA, or similar, approved format acceptance test form as described herein. All acceptance tests shall be performed in the presence of the Owner.

1. Hydrostatic tests in accordance with NFPA 13. Test to consist of holding test pressure at the high end for a period of two hours. Test pressure is 200 psi or 50 psi over normal operating pressure, whichever is greater.
 2. Flushing of piping in accordance with NFPA 24 and NFPA 13.
 3. Test of sprinkler supervisory system. The fire alarm contractor shall be present at the testing of all sprinkler alarm and supervisory devices. The Contractor shall coordinate the final testing of all such devices with the fire alarm contractor.
- D. Final approval and acceptance of the work will be given by the Owner when:
1. The completed sprinkler system has been inspected, tested, and approved by the Owner and AHJ.
 2. Required submittals, system operation and maintenance manuals, record drawings, spare parts, special tools, and training have been provided to, reviewed, and accepted by the Owner.
 3. Written certification is submitted that states that all equipment has been inspected and tested by a manufacturer's certified representative.
 4. Written certification is submitted that states that all equipment is installed in accordance with the manufacturer's recommendations and UL and/or FM approvals.
- E. Additional Tests: Any additional tests required by the referenced codes, standards, guidelines/criteria, or the Owner shall be performed. This documentation shall include:
1. The date and time of each test.
 2. A reference set of contractor record drawings, numerically identifying the individual components and circuits tested, test locations, and indicating the measured sound level.
 3. A description of each test performed.
 4. A checklist of each device tested, indicating the results of each test.
 5. The names and signatures of the individuals conducting and witnessing each test.

3.19 CLEANING AND PROTECTION

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.
- C. Maintain the premises free from accumulation of waste materials or rubbish caused by this work.

- D. Sprinklers shall be covered with paper or plastic bags when installed prior to painting of the building interior. The paper or plastic bag coverings shall only be removed once building painting has been completed.

3.20 DEMONSTRATION

- A. Engage a factory-authorized service representative to train or train the Owner's maintenance personnel to adjust, operate, and maintain the system.

END OF SECTION

SECTION 22 00 00

PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Division 1 applies to this section. Provide plumbing as indicated, specified, and required.

1.2 PRODUCT HANDLING

- A. Protection: Take all precautions necessary to protect the materials of this section before, during, and after installation.
- B. Replacements: In the event of damage, immediately repair all damaged and defective work to the approval of the Architect at no additional cost to the Owner.

1.3 LOCATION AND ACCESSIBILITY

- A. Valves, motors and other devices requiring service, maintenance and adjustment shall be placed in fully accessible positions and locations.
- B. Drawings: Coordinate all space requirements with other trades. All offsets and interferences may not be indicated due to the scale of the drawings.

1.4 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. All governing codes, ordinances and agencies, in accordance with the provisions of Division 1 of these specifications.
- B. Warranty: The contractor shall furnish a written warranty for labor, materials and equipment provided under this contract in accordance with the provisions of Division 1 of these specifications.

1.5 DISCREPANCIES

- A. The Contractor shall check all Drawings furnished immediately upon their receipt and shall promptly notify the Owner's Representative of any discrepancies.
- B. Where requirements between Drawings and Specifications conflict, the more restrictive provisions shall apply.
- C. If any part of the Specifications or Drawings appears unclear or contradictory, apply to Owner's Representative for interpretation and decision as early as possible, including during bidding period. Do not proceed with such work without Owner Representatives decision. Beginning work of any Section constitutes acceptance of conditions.

1.6 SUBMITTALS

- A. Manufacturer's Literature: Submit brochures on all materials and equipment to the Architect in accordance with the provisions of Division 1 of these specifications.
- B. Other Submittals:
 - 1. Shop Drawings.
 - 2. Sterilization Test Report.
 - 3. Test Data.
 - 4. Operations and Maintenance Manuals.
 - 5. Record Drawings.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Pipe Escutcheons: Provide polished chromium plate and brass set screw escutcheons where plumbing pipes pass through walls, floors, ceilings, and partitions in finished portions of building, including pipes at fixtures.
- B. Pipe Identification:
 - 1. Piping identification per California Plumbing Code Requirements and pipes not covered by the Plumbing Code shall be per ANSI standards: Each individual pipeline shall be marked for quick and easy identification as to content, direction of flow, and character of material carried in the pipes by Seton SNA or STR markers.
 - 2. Markers shall be installed and spaced at not more than 20 ft. intervals, but not less than once per room and so located that markers shall be visible from floor level.
 - a. One marker shall be installed at each side of valves, special fittings and at branch take-off. In furred spaces install one band 2 ft. above floor and 19 in. below ceiling line.
 - 3. Color scheme shall be approved. Base color for markers shall be as follows:
 - a. Domestic hot water - Yellow w/Black Letters
 - b. Domestic cold water - Green w/White Letters
 - c. Fuel gas - Yellow w/Black Letters
 - d. Sanitary sewer - Green w/White Letters

- e. Sanitary vent - Green w/White Letters
- f. Condensate – Yellow w/Black Letters

C. Valve Identification:

- 1. Valve tags: Provide a tag consisting of a 2 in. dia. 20 ga. stainless steel or brass disk for each main and branch line shut-off valve or cock. Fasten tags in place with continuous steel ring or chain around stem of valves and round pipe for cocks. Two inch letters and figures stenciled in contrasting colors on pipe or pipe covering may be substituted for tags on OS&Y valves. Disks shall be stamped with service designation, with 1/4 in. high letters.

D. Materials: Materials when not otherwise definitely specified shall conform to the applicable standards.

E. Equal Materials and Substitutions: In addition to manufacturers specified, the following shall also be considered equal, provided corresponding models meet specified requirements. Equivalent substituted equipment named herein shall be submitted to Architect for approval. Submit alternate selections at time of bid, listing major equipment.

F. <u>ITEM</u>	<u>MANUFACTURER</u>
1. Access Panels:	Milcor, Mifab
2. Angle Stops & Supplies:	Brasscraft, Speedway
3. Cleanouts:	Wade, Zurn , JR Smith, Josam
4. Insulation:	3M, Manville, Fiberglas
5. No-Hub Couplings:	Clamp-All, Mission, Husky
6. Pipe Hangers & Supports:	Tolco, B-Line, Hilti
7. Soil Pipe:	Tyler, Charlotte
8. Solders:	Handy-Harman, Lucas, Milhaupt
9. Valves:	Crane, Red-White, Milwaukee

2.2 PIPE AND FITTING SCHEDULE

- A. Soil, waste, vent and storm drain piping to 5 ft. outside building: Cast-iron soil pipe and fittings shall conform and be installed to the requirements of CISPI Standard 301, ASTM A888 or ASTM A74 for all pipe and fittings. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be listed by NSF International or receive prior approval of the engineer. Wrap all underground piping per paragraph 3.10 herein. Tyler, A. B. & I., Charlotte.

- B. Domestic hot and cold water piping above ground: Type L hard-drawn copper tube, ASTM B88, and wrought copper fittings, ANSI B16.22.
- C. Domestic cold water piping below ground and outside the building:
 - 1. 3 in. and smaller: Type K hard-drawn copper tube, ASTM B88, and wrought copper fittings ANSI B16.22, solder joint type (refer to paragraph 3.09 herein).
- D. Indirect and Condensate Drains: Type M copper tube, ASTM B88 and wrought copper fittings, ANSI B16.22, solder joint type. Coordinate condensate trap installation with air conditioning unit manufacturer. All interior condensate drain piping shall be insulated with AP Armflex closed-cell Elastomeric foam insulation.
- E. Gas Piping:
 - 1. 3 in. and smaller above ground: Schedule 40 black steel pipe, ASTM A-135, A-795, with Class 150 WOG black banded malleable iron screwed fittings. Paint all exposed piping in accordance with Division 1.

2.3 MATERIALS FOR JOINTS, FITTINGS AND VALVES

- A. Soil, Waste and Vent Drain Cast-Iron Pipe:
 - 1. Above Ground: Type 304 Series stainless steel, "No-Hub" standard duty, shielded couplings shall conform to Cast Iron Soil Pipe Institute, CISPI-310-85 and shall be listed by NSF International with stainless steel corrugated shield, stainless steel bands and tightening devices and ASTM C564 rubber sleeve. Equivalent to Tyler, Husky HD 2000, A. B. & I.
 - 2. Below Ground: Type 304 stainless steel, "No-Hub" by the Cast Iron Soil Pipe Institute, CISPI-310-85 with stainless steel shield, stainless steel band and tightening devices and ASTM C564 neoprene rubber gasket. Equivalent to Husky SD-4000.
- B. Solder and Flux:
 - 1. Water Piping: Equivalent to Harris "Bridgit" stay safe lead-free solder alloy (ASTM B 813) with stay clean paste flux. 95-5 solders are not approved. Below ground piping shall have brazed joints with silver solder.
 - 2. Copper Indirect and Condensate Drainage Piping: Lead-free solder with non-corrosive paste flux.
- C. Welded Joints: Welding shall be performed only by qualified welders, and shall comply with ASME Boiler Construction Code, ANSI Code for pressure piping, and state requirements.
- D. Unions and Gaskets:
 - 1. 2 in. and under for steel pipe: Screwed malleable-iron ground joint, Class 150 WOG, with brass-to-iron seat, galvanized or black to suit service.

2. 2-1/2 in. and larger for steel pipe: Cast-iron flanged gasket type, conforming to ANSI B16.1, galvanized or black to suit service, or 150 lb. forged steel slip-on flanges.
 3. Unions for copper tubing: Cast bronze, ground joint pattern, soldered joint connection, ASTM B62 and ANSI B16.18.
 4. Dielectric Unions: Complete with isolators and gaskets of same size as pipe, galvanized or black to suit service. Watts series 3004/LF3004 galvanized or Watts series 3006 black steel.
 5. Dielectric Flanges: F.H. Maloney Co., Type E flanges for cathodic insulation.
 6. Gaskets: 1/16 in. Garlock #17022.
- E. Valves: Valves shall be lead-free and of same manufacturer or following numbers or equivalent by comparator chart of approved manufacturer. Provide adapters for valves in copper tubing where necessary. All domestic water valves, 2-1/2 in. and smaller, shall be full port ball valves.
1. Eccentric valves, 2 in. and smaller, gas: "SMG" PPG series valve with 316 stainless steel, plug carbon steel, body, screwed or flanged, PTFE seats, U.L. listed.
 2. Ball valves, domestic water 2-1/2 in. and smaller: Lead-free Bronze, body and brass materials fullport, solid ball class 150, MPTFE seats and stem packing. MSSSP-110, ANSI/NSF 61-8. Apollo 77CLF-100 Series, Nibco S/T685-80-LF, Watts B6080 Series (Threaded) and B6801 Series (Soldered) or Red and White 5044 AB.
- F. Check Valves:
1. Domestic Water Systems:
 - a. In-Line check valve, 2 in. and smaller, lead-free bronze body, threaded, stainless steel spring. Apollo model CVB-61LF series, Nibco T-480-Y-LF.
 - b. Dual Check Valve, 1 in. and smaller, lead-free composite body with corrosion resistant internal parts, two independently operated in-line spring loaded modular checks. Wilkins Model 705-XL, Apollo model DUC-4NLF.
- ## 2.4 PIPE HANGERS
- A. Hangers shall be supplied with factory installed isolation and di-chromate finish.
1. 2 in. and smaller: Grinnell F69.
 2. 2-1/2 in. and larger: Grinnell F65.
- ## 2.5 ACCESS PANELS

- A. Access Panels in Acoustic Tile Ceilings: Karp #DSC-210, Elmdor AT, 24x24 in. with metal access door and frame, 24x24 in. minimum size, prime coated steel, recessed to accept standard tile in full opening door.
- B. Access Panels in Ceramic Tile Walls: Karp #DSC214M, Smith 4730, chrome-plated cover and frame of suitable size for purpose intended, but not less than 8x8 in. size. For fire rated areas use Karp #FRP-150 FR 1-1/2 hour "B" Label access panels, U.L. listed.

2.6 CLEANOUTS

- A. For cast-iron soil pipe, iron body with extra heavy bronze plugs screwed into caulking ferrules; for steel pipe, extra heavy bronze plugs; and for vitrified clay pipe, vitrified clay plugs. Where cleanouts occur in finished interior walls, provide access panels, plates, and frames for flush mounting. Exposed parts of floor cleanouts shall have adjustable top. All cleanouts and cleanout plugs shall be accessible. Cleanouts for drain pipes that pass through a backwater valve shall be identified with a permanent label stating "BACKWATER VALVE DOWNSTREAM." Cleanout shall be the following:
 - 1. Smith - 4023
 - 2. Zurn - ZN-1402-2
 - 3. Mifab – C-1100-R
- B. In finished floors: Cast-iron with polished nickel bronze round top, non-skid diamond tread set flush with the floor. Provide with carpet marker when located in future carpeted areas and flashing flange when used with waterproofing membrane.
 - 1. Smith - 4023
 - 2. Zurn - ZN-1402-2
 - 3. Mifab – C-1100-R
- C. In walls: Cleanout tee with squared polished nickel bronze access plate with vandalproof screws and frames. Opening 8x8 in. minimum.
 - 1. Smith - 4558-U
 - 2. Zurn - ZN-1447
 - 3. Mifab – C-1460-S

2.7 INSULATION

- A. All pipe insulation shall comply with the State of California Energy Conservation Standards. Insulation thicknesses indicated are based on insulation having thermal resistances in the range of R-4.0 to R-4.6 per inch of thickness on a flat surface at a mean temperature of 75 degrees F. Thicknesses indicated are minimum and shall be increased proportionately for materials having R values less than 4.0 per inch of thickness or may be reduced for materials having R values greater than 4.6 per inch thickness. Install pipe insulation after piping is installed, tested and approved and is in clean, dry condition. Firmly butt insulation joints.
- B. Insulate all hot water and interior condensate drain piping with glass fiber pipe insulation with factory applied white jacket, J-M Micro-Lok 650 AP, 1 in. thick for pipe

sizes of 1/2 in. to 1 in., and 1-1/2 in. thick for pipe sizes to 1-1/4 in. and larger. Insulate fittings and valves with preformed insulation with PVC premolded one piece fitting cover, J.M. Zeston cover. Adhere longitudinal laps and butts of strips of jacket with factory applied pressure sensitive tape system, J-M AP-T. Flanges and unions shall not be covered.

- C. Insulate all piping under lavatories and sinks accessible to the physically disabled with Truebro LavGuard2 or Plumberex Pro-Extreme, hot and cold water supply and 'P' trap form fitted insulation.
- D. Insulate all interior condensate drain piping with AP Armaflex closed-cell elastomeric foam insulation. Flame-spread index of 25 or less and smoke-developed index of 50 or less. 1/2-inch thick for 4-in. diameter pipe and less.

2.8 PLUMBING FIXTURES

- A. General: Plumbing fixtures trim and exposed supplies and wastes shall be brass with polished chrome-plated finish. Provide individual loose key stops or, if so specified, screw driver stops for supplies and, unless integral with valves or faucets, mount under fixture. Separately trap all wastes. Provide exposed supplies and wastes to wall with polished chrome-plated cast brass wall escutcheons. All lavatories shall have 1-1/2 in. 17 gauge chrome-plated cast brass P-traps. All plumbing fixtures shall be white, unless otherwise noted.
- B. Wall-Hung Fixtures: Fixtures specified with hangers or supporting arms shall have hangers or arms securely mounted on a 1/4 in. thick by 6 in. wide steel wall plate which extends at least one stud beyond first and last fixture mounting points, or a total of three studs minimum. Attach wall plate to each structural stud it crosses by tack welding each side of stud flange at top and bottom of plate. Fixture or supporting arms shall be securely and firmly attached to steel wall plate in accordance with manufacturer's instructions. If structural studs are not being installed behind wall-hung fixtures, plumbing contractor shall notify Architect and Mechanical Engineer immediately.
- C. Floor-Mounted Water Closets: Install on slotted cast-iron floor flanges. Make joints permanently gas and watertight with a preformed wax gasket and held in place with 5/16-in. solid brass bolts concealed with vitreous china bolt caps. Color to match fixture.
- D. Urinals: Install with brass nipples. Install at heights indicated on Architectural drawings. Conceal fixture bolts with vitreous china caps. Color to match fixture.
- E. Fixtures, trim and accessories shall be equal, unless otherwise noted to the following:

2.9 SPECIALTY ITEMS

- A. Instantaneous electric Water Heater: Point-of-Use electric instantaneous water heater, micro-processor controlled, 98% energy efficient, U. L. listed, factory pre-set outlet temperature of 110° F, field serviceable heating element, high temperature limit switch, turn-on flow rate of 0.3 gpm. Provide with "Watts" LFFS-CFS-S Floodsafe, lead-free braided stainless steel cold water supply connector with compression fittings

and "Watts" 3/8"-05-CXT water hammer arrestor on cold water angle stop. Refer to Water Heater Schedule in drawings for characteristics.

2.10 VIBRATION ISOLATION

A. Domestic Hot and Cold Water Piping:

1. Riser Support: 0.06 inch deflection Type A neoprene pads with load distribution pads under riser clamps.
2. Horizontal Piping: Minimum 3/8 inch felt between pipe and clevis hanger.
3. Miscellaneous Attachments: Trisolators.
4. Seismic Restraints: Suspended piping-cables as required by code.

B. Water Heater(s):

1. 0.06 inch deflection Type A neoprene pads.

2.11 VIBRATION ISOLATORS

- A. Type A: Neoprene pad. Waffle, ribbed or other forms. Typically 1/4 to 5/16 inch thick. Durometers of 40 to 65. Static deflections from 0.01 to 0.07 inches. Nominal design 40 durometer for 0.05 inches static deflections. Provide steel load distribution plates. Size of pad to be specified by isolator supplier based on load per pot. Mason W and WM, Vibrex R, or equal.
- B. Type B: Trisolators. Sheet metal sleeve with felt insert to be installed at attachments of points of hangers or piping. Semco, Elcen, or equivalent shop fabricated device.

2.12 COMMERCIAL ELECTRIC WATER HEATERS

- A. Commercial, Storage Electric Water Heaters: Comply with UL 1453 requirements for storage-tank-type water heaters.
 1. Manufacturers:
 - a. Bradford White Corporation.
 - b. Rheem.
 - c. A.O. Smith.
 2. Storage-Tank Construction: Non-ASME-code, steel vertical arrangement, glass lined.
 - a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.

- 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - b. Pressure Rating: 150 psig.
 - c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
3. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Extruded high density.
 - b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - c. Insulation: Comply with ASHRAE/IESNA 90.1.
 - d. Jacket: Steel with enameled finish.
 - e. Heating Elements: Medium watt density with zinc-plated copper sheath.
 - f. Temperature Control: Adjustable thermostat.
 - g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
 - h. Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
4. Special Requirements: NSF 5 construction.
5. Capacity and Characteristics:
 - a. As indicated on Plumbing Drawings.

2.13 COMPRESSION TANKS

- A. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
 1. Manufacturers:
 - a. AMTROL Inc.
 - b. Watts Regulator Co.
 - c. Wessels Co.

2. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1, pipe thread.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
3. Capacity and Characteristics:
 - a. Working-Pressure Rating: 150 psig.
 - b. Capacity Acceptable: 2 gal. minimum.
 - c. Air Precharge Pressure: 55 psig.

2.14 WATER HEATER ACCESSORIES

- A. Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
- B. Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include pressure setting less than water heater working-pressure rating.
- C. Water Heater Stands: Water heater manufacturer's factory-fabricated steel stand for floor mounting and capable of supporting water heater and water. Include dimension that will support bottom of water heater a minimum of 18 inches above the floor.
- D. Water Heater Restraint System: Heavy duty water heater seismic restraint system for wall mounting. Install per Manufacturer's direction and detail on plan.
- E. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of water heater and include drain outlet not less than NPS 3/4.

2.15 SOURCE QUALITY CONTROL

- A. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test water heater storage tanks before shipment to minimum of one and one-half times pressure rating.
- C. Prepare test reports.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection: All plumbing shall be installed in accordance with the requirements of all governing authorities, the original design, and the referenced standards.
- B. Discrepancies:
 - 1. In the event of discrepancy, immediately notify the Architect.
 - 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
 - 3. Interferences between installed work of various trades due to lack of coordination shall be resolved by Architect whose decision is final. Relocate or offset any work as required to accommodate work of other trades at no extra cost to the Owner when so directed by the Architect.

3.2 LOCATIONS AND SPACE REQUIREMENTS

- A. Contractor shall fully inform himself regarding peculiarities and limitations of spaces available for installation of work under this division. Drawings indicate desired location and arrangement of piping, equipment and other items, and are to be followed as closely as possible. Work specified and not clearly defined by drawings shall be installed and arranged in a manner satisfactory to Architect. In event changes in indicated locations and arrangements are deemed necessary by Architect, they shall be made by Contractor without additional charge provided the change is ordered before work is installed and no extra materials are required.
- B. Verify all spaces, dimensions for all fixtures, equipment, tenant or Owner-furnished equipment and equipment furnished under other sections.
- C. Obtain all necessary rough in data and dimensions for all fixtures, equipment, tenant or Owner-furnished equipment and equipment furnished under other sections.
- D. Maintain ample headroom clearances and accessibility. Maintain ceiling heights.
- E. Constantly check work of other trades to prevent interference with this installation.

3.3 PIPE INSTALLATION

- A. Make pipe runs straight and true. Springing or forcing piping into place is not permitted. Install in manner to prevent any undue strain on equipment. Make joints smooth and unobstructed inside and out, and ream pipe ends thoroughly to remove burrs. Conceal piping in finished portions of the buildings except as otherwise directed or indicated. Cap or plug ends and openings in pipe and fittings immediately to exclude dirt until equipment is installed or final connections are made. Make pipe size reductions with reducing fittings. Use no bushings unless specifically authorized. Use no close nipples. Proceed to rough in as rapidly as general construction of building will permit and complete and test before any lathing, plastering, or drywall, or other finish work is started. Fit work to available space and accurately rough in. Grade and valve water piping so as to provide for complete drainage and control of the system. Provide clamps and/or concrete thrust blocks at dead ends, angles, or other points where separation of joints may occur. Grade vent piping to allow piping

to free itself of condensation or water. Pipe and supports shall not be in contact with structure, other piping, conduit, ductwork or other equipment.

- B. Install piping to clear beams unless sleeving is indicated. Constantly check work of other trades to prevent interference with this installation. Obtain approval from Architect if coring or cutting of concrete work is necessary due to failure to install required sleeves prior to the time of concrete pour. Cost of coring and cutting work shall be borne by the subcontractor.
- C. Exposed Plated or Enameled Pipe: Make connections to equipment with special care. Show no tool marks or threads.
- D. Dielectric Unions: Make connections between two dissimilar metal pipes with dielectric unions.
- E. Unions: Provide a union at both sides of automatic valves, at equipment connections and elsewhere indicated or required, unless flanges are indicated.
- F. Floor, Wall and Ceiling Plates: Provide where pipes pierce finished surfaces.
- G. Noise: Install soil, waste, and water piping in manner that prevents any unusual noise from flow of water under normal conditions.
- H. Shutoff Valves: Provide where indicated and required for adequate control of systems and for isolation of fixture groups and equipment.
- I. Buried Piping: Install with minimum 36 in. coverage unless otherwise indicated. Lay piping accurately to grade where invert elevations are indicated. When required, provide thrust blocks per manufacturer's recommendations.
- J. Equipment and Materials: Install per manufacturer's recommendations.
- K. Accessibility: Install work readily accessible for normal operation, reading of instruments, adjustment, service, inspection and repair. Provide access panels where indicated and required.
- L. Pipe Joints: Make screwed joints with a minimum amount of compound applied to the male thread only. All joints shall be made per code requirements. Use of "Bull Head" tees in domestic water system is prohibited.
- M. Pipe Supports: Support or secure to building construction or firmly anchor waste, vent, and water pipes in such a manner that they cannot be displaced. Use of makeshift devices such as wire, rope, wood, and tape, etc., is prohibited.
- N. Pumped Condensate Piping: Install flat with minimal offsets at one elevation within the ceiling space.

3.4 HANGERS AND SUPPORTS

- A. Hold horizontal pipe runs firmly in place using approved steel and iron hangers, supports, and/or pipe rests unless otherwise indicated. Suspend hanger rods from concrete inserts or from approved brackets, clamps or clips. Hang pipes individually

or in groups if supporting structure is adequate to support weight of piping and fluid. Except for buried piping, hang or support pipe runs so that they may expand or contract freely without strain to pipe or equipment.

1. Horizontal steel piping: Provide hangers or supports every 10 ft. except every 8 ft. for piping 1-1/4 in. and smaller.
 2. Horizontal copper tubing: For 2 in. diameter and over, provide hangers every 10 ft.; for 1-1/2 in. diameter and smaller, every 6 ft.
 3. Horizontal cast-iron hub and spigot piping: Provide hangers or supports at each hub.
 4. Horizontal cast-iron no-hub piping: Provide hangers or supports at each side of a no-hub fitting. Provide anti-separation bracing at each 90 degree change of direction.
 5. Vertical piping: Support at floor with iron pipe clamps.
 6. Sway brace in accordance with NFPA 13.
- B. Branches: Provide separate hangers or supports for branch lines 6 ft. or more in length.
- C. Sound and Electrolysis Isolators: Provide at all hangers and supports for hot and cold domestic water lines. Securely attach pipe to walls, studs, etc. All such piping isolated from structure by 1/2 inch felt or "Trisolators".

3.5 EXPANSION AND CONTRACTION

- A. Install piping subject to expansion and contraction with expansion loops made up of bends, fittings, or Victaulic couplings, expansion joints, swing joints, or other approved methods or devices. Branch lines from mains subject to expansion and contraction shall have a swing joint at a point of connection with the main. Risers which pass through one or more floors shall have swing joints at their base. Anchor lines subject to expansion and contraction by approved methods to restrict movement.

3.6 CORROSION PREVENTION

- A. Make joint between cuprous and ferrous materials with approved nylon insulating couplings. Separate contact surfaces of dissimilar metals with non-conducting coating.

3.7 CLEANOUTS

- A. Provide cleanouts where indicated and required. Unless otherwise indicated, cleanouts shall be accessible with extensions to grade, to outside of buildings, or to floors above as indicated or required. Do not locate cleanouts in public lobbies and public corridors unless approved by Architect.

- B. Membranes: Where waterproofing membrane occurs under floor, bring membrane to cleanout without puncturing, and permanently anchor to integral anchoring flange with a heavy cast-iron clamping collar and rustproofed bolts.
- C. Covers: Set cleanout covers with all finished wall, floor or grade. In all cases securely anchor by means of integral lugs and bolts. Where surfacing material such as resilient covering is specified, ascertain thickness being used and set cleanout top so finished floor is smooth.
- D. Use Acorn 3500 thread compound.

3.8 ACCESS BOXES AND PANELS

- A. Provide valve boxes for valves located below grade. Provide metal access panels of size and type hereinbefore specified for valves or shock absorbers located in concealed areas.
- B. Access Boxes and Panels: Set flush with finished wall, floor or ceiling. Those in finished walls shall have door or plate removed during construction or be otherwise suitably covered to protect finish.
- C. Outside General Service Access Boxes: Provide with metal or clay pipe sleeve extensions where added depth is necessary. Do not locate boxes in public walks, driveways or covered passages unless indicated.

3.9 WRAPPING FOR BURIED STEEL AND COPPER PIPING

- A. All buried steel pipe shall be factory coated with Plexco 20 mil high density polyethylene coating (yellow color). Finished coating shall have continuous imprinting of coating type and applicator and pipe type and manufacturer. All fittings and field joints of buried steel piping shall be cleaned, primed then fully protected by wrapping with two separate wrappings (each half lapped) of 0.010x2 in. wide pressure sensitive polyvinyl tape. All fitting and joint wrapping shall overlap pipe wrapping a minimum of 2 in.
- B. Affidavit: Deliver coated pipe to jobsite accompanied by applicator's affidavit certifying that wrapped pipe has been given high voltage holiday detector test and that pipe was free of holidays when pipe was shipped from applicator's yard. Submit one copy of every affidavit to Architect prior to installation.
- C. Field Joints: Test field applications for holidays by a high voltage holiday test method in Architect's presence.
- D. Damage: Handle wrapped piping with extreme care to avoid damage. Repair and retest marred or damaged pipe wrapping.
- E. Install cathodic protection for steel or ferrous piping per Corrosion Engineer's recommendations and/or applicator contractor familiar with cathodic protection having a minimum of 5 years experience in the fabrication and installation of cathodic protection.

- F. Copper tubing, pipe wrap same as for field wrap steel fittings, no holiday test required. Backfill with clean sand.
- G. Backfill steel and copper piping with clean sand a minimum of 4 inches all around pipe and fittings.

3.10 PROTECTION FOR UNDERGROUND DUCTILE AND CAST-IRON PIPE AND FITTINGS

- A. Where required per geotechnical report, Wrap all pipe and fittings with 8 mil polyethylene encasements in accordance with ANSI/AWWA Standard C105/A21.5-93. Bed and backfill with clean sand at least 6 inches thick surrounding the pipe. Underground iron pipe should also be electrically insulated from dissimilar metals and above ground iron pipe.

3.11 EXCAVATION AND BACKFILLING

- A. Perform excavation and backfilling required work under this section unless otherwise specified. Conform to requirements of Division 2 and of public authorities having jurisdiction.

3.12 SPECIALTY ITEMS

- A. Install as indicated on the drawings, as herein specified, and as recommended by manufacturer.

3.13 STERILIZATION

- A. Domestic Water System: Sterilize each unit of water supply and distribution system with liquid chloride or hypochloride before acceptance for operation in accordance with AWWA C651-92, "Standard for Disinfecting Water Mains." Work shall be done by Contractor and, unless otherwise required by public authorities having jurisdiction, shall conform to the following:
 - 1. Materials:
 - a. Liquid chlorine: U.S. Army Specification 4-1.
 - b. Hypochloride: Liquid shall conform to Fed. Spec. O-C-11RA (Int. 4).
 - 2. Method: Amount of chlorine shall provide a dosage of 50 ppm minimum. Introduce chlorinating materials into lines and distribution system in approved manner. After a contact period of 24 hours minimum during which period chlorine residual shall be maintained at 5 ppm minimum, flush out systems with clean water until residual content is not greater than 0.2 ppm. Flush entire system open and close valves in lines being sterilized several times during contact period.
 - 3. Test Reports: Furnish one copy of test report of complete and adequate sterilization to Architect before final acceptance of work. Certificates shall bear signature of an official of laboratory responsible for test. Cost of testing laboratory services shall be included in this subcontract.

3.14 TESTS

- A. Perform tests to Architect's satisfaction. Make tests in presence of Architect and at a time suitable to him if requested. Furnish necessary labor and equipment and bear costs for testing. Cost of replacing and/or repairing damage resulting therefrom shall be borne by this Contractor. Should the Contractor refuse or neglect to make tests necessary to satisfy the Architect that requirement of specifications and drawings are met, such tests may be made by an independent testing company and the Contractor charged for all expenses.
- B. Hydrostatic Tests: Make by completely filling piping system with water and eliminating accumulations of air so that leakage, no matter how small, will be apparent on testing gauge immediately. Maintain pressure until pipe under test has been examined, but in no case less than 24 hours. Test systems at following pressure:
- | | |
|------------------------|----------------------|
| 1. <u>SYSTEM</u> | <u>TEST PRESSURE</u> |
| C. Domestic cold water | 150 psig |
| D. Domestic hot water | 150 psig |
- E. Sanitary Soil, Waste, Vent System Tests: Before installation of fixtures, cap ends of system and fill lines with water to 10 ft. above the section being tested (including vents) and allow to stand until a thorough inspection is made. Make tests in sections if necessary or convenient. However, include interconnections between new sections and previously tested sections in the new test.
- F. Roof Drainage System: Test as specified for sanitary system.
- G. Gas Systems: Test with compressed air for six hours or longer as directed to prove tight without leaks. Use pressure recorder to record pressure of all lines for duration of test. Test at 60 PSIG.

3.15 ADJUSTING

- A. Upon completion of work and after cleaning of system, fixtures and equipment, and automatic parts of plumbing system shall be carefully adjusted for normal operation. All flush valves and fixture stops shall be checked for proper operation and final adjustments made where required. System shall operate quietly without vibration or noise.

3.16 WATER HEATER INSTALLATION

- A. Install commercial water heaters on concrete bases.

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Transition fittings.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Sleeves.
 - 5. Escutcheons.
 - 6. Grout.
 - 7. Equipment installation requirements common to equipment sections.
 - 8. Painting and finishing.
 - 9. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.
2. PE: Polyethylene plastic.
3. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include but are not limited to, the manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.2 PAINTING

- A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.3 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.4 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.5 GROUTING

- A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motors 7.5 HP and larger; rolled steel for motors 7.5 HP smaller than.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multi-speed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multi-speed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal framing systems.
 - 2. Equipment supports.
- B. Related Sections:
 - 1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
 - 3. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Metal framing systems.
 - 3. Fiberglass strut systems.
 - 4. Pipe stands.
 - 5. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of trapeze hangers.
 - 2. Design Calculations: Calculate requirements for designing trapeze hangers.
- D. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper B-Line, Inc.
 - b. Unistrut Corporation; Tyco International, Ltd.
 - 2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
 - 3. Standard: MFMA-4.
 - 4. Channels: Continuous slotted steel channel with inturred lips.
 - 5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
 - 7. Metallic Coating: Manufacturer's standard finish.
 - 8. Plastic Coating: Plastic coating, jacket or liner.

2.2 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.3 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.
- F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- G. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely

- cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- H. Pipe Stand Installation:
- 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 07 Section "Roof Accessories" for curbs.
- I. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- L. Install lateral bracing with pipe hangers and supports to prevent swaying.
- M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- N. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- P. Insulated Piping:
- 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 23 05 48

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Isolation pads.
 - 2. Isolation mounts.
 - 3. Restrained elastomeric isolation mounts.
 - 4. Freestanding and restrained spring isolators.
 - 5. Housed spring mounts.
 - 6. Spring hangers.
 - 7. Spring hangers with vertical-limit stops.
 - 8. Restrained vibration isolation roof-curb rails.
 - 9. Restraining braces and cables.

1.3 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
 - 3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

- B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.
 - a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Division 22 Sections for equipment mounted outdoors.
 - 2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
 - 3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
 - 4. Seismic-Restraint Details:
 - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Division 22 Sections for equipment mounted outdoors.
 - d. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).
- C. Coordination Drawings: Show coordination of seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.
- D. Welding certificates.
- E. Qualification Data: For professional engineer and testing agency.
- F. Field quality-control test reports.
- G. Operation and Maintenance Data: For air-mounting systems to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. M.W. Sausse & Company, Inc.
 - 2. Mason Industries.
- B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - 1. Resilient Material: Oil- and water-resistant rubber.
- C. Mounts Insert drawing designation: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.
 - 1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - 2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

- D. Restrained Mounts: All-directional mountings with seismic restraint.
 - 1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - 2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
- E. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
 - 1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
 - 6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- F. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
 - 1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 - 2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
 - 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- G. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.
 - 1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
 - 2. Base: Factory drilled for bolting to structure.
 - 3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel up or down before contacting a resilient collar.
- H. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
- I. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.
1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.2 RESTRAINED VIBRATION ISOLATION ROOF-CURB RAILS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. M.W. Sausse & Company, Inc.
 2. Mason Industries.
- B. General Requirements for Restrained Vibration Isolation Roof-Curb Rails: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic forces.
- C. Lower Support Assembly: Formed sheet-metal section containing adjustable and removable steel springs that support upper frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist seismic forces. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly.

- D. Spring Isolators: Adjustable, restrained spring isolators shall be mounted on 1/4-inch-thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.
 - 1. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
 - a. Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
 - b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 2. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - a. Resilient Material: Oil- and water-resistant natural rubber.
- E. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.
- F. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

2.3 VIBRATION ISOLATION EQUIPMENT BASES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. M.W. Sausse & Company, Inc.
 - 2. Mason Industries.
- B. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.
 - 1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - a. Include supports for suction and discharge elbows for pumps.
 - 2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.

3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

2.4 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. M.W. Sausse & Company, Inc.
 2. Mason Industries.
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
 1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
 2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
 3. Maximum 1/4-inch air gap, and minimum 1/4-inch- thick resilient cushion.
- D. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- E. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- F. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- G. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
- H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.
- I. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

- J. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
- K. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.5 FACTORY FINISHES

- A. Finish: Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 - 1. Powder coating on springs and housings.
 - 2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 - 3. Baked enamel or powder coat for metal components on isolators for interior use.
 - 4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

B. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

F. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

G. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

H. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 - 5. Test to 90 percent of rated proof load of device.
 - 6. Measure isolator restraint clearance.
 - 7. Measure isolator deflection.
 - 8. Verify snubber minimum clearances.
 - 9. Air-Mounting System Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 10. Air-Mounting System Operational Test: Test the compressed-air leveling system.
 - 11. Test and adjust air-mounting system controls and safeties.
 - 12. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust air-spring leveling mechanism.
- D. Adjust active height of spring isolators.

- E. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-mounting systems. Refer to demonstration and training requirements in Division 01 Section

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING & EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Duct labels.
 - 4. Stencils.
 - 5. Warning tags.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel, as required to mount on equipment.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
4. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
5. Fasteners: Stainless-steel, as required to mount on equipment.
6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

- C. Background Color: Yellow.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel, as required to mount equipment.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Maximum Temperature: Able to withstand temperatures up to 160 deg. F.
- C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
- D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- E. Fasteners: Stainless-steel, as required to mount equipment.
- F. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- G. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.4 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
 - 1. Stencil Material: Fiberboard.
 - 2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
 - 3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link chain.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - 1. Size: Approximately 4 by 7 inches.
 - 2. Fasteners: Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.

- B. Locate equipment labels where accessible and visible.

3.3 DUCT LABEL INSTALLATION

- A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
 - 1. Green: For cold-air supply ducts.
 - 2. Yellow: For hot-air supply ducts.
 - 3. Blue: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 - 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
- B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.
- C. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.4 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Balancing Air Systems:
 - a. Constant-volume air systems.
- 2. Testing, Adjusting, and Balancing Equipment:
- 3. Duct leakage tests.
- 4. Control system verification.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. BAS: Building automation systems.
- C. NEBB: National Environmental Balancing Bureau.
- D. TAB: Testing, adjusting, and balancing.
- E. TABB: Testing, Adjusting, and Balancing Bureau.
- F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- G. TDH: Total dynamic head.

1.4 PREINSTALLATION MEETINGS

- A. TAB Conference: If requested by the Owner, conduct a TAB teleconference after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.
 - 1. Minimum Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.

- c. Needs for coordination and cooperation of trades and subcontractors.
- d. Proposed procedures for documentation and communication flow.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- D. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.
- E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.
- F. Certified TAB reports.
- G. Sample report forms.
- H. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.

1.6 QUALITY ASSURANCE

- A. TAB Specialists Qualifications: Certified by AABC.
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
 - 2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

1.7 FIELD CONDITIONS

- A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

- A. Subject to compliance with requirements, available TAB specialists that may be engaged include, but are not limited to, the following:
 - 1. National Air Balance Company, Inc.
 - 2. MESA3, Inc.
 - 3. Pacific Teat and Balance, Inc.

3.2 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use

tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as zone boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine operating safety interlocks and controls on HVAC equipment.
- L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3 PREPARATION

- A. Prepare a TAB plan that includes the following:
 - 1. Equipment and systems to be tested.
 - 2. Strategies and step-by-step procedures for balancing the systems.
 - 3. Instrumentation to be used.
 - 4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Airside:
 - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
 - b. Duct systems are complete with terminals installed.
 - c. Volume, smoke, and fire dampers are open and functional.
 - d. Clean filters are installed.
 - e. Fans are operating, free of vibration, and rotating in correct direction.
 - f. Variable-frequency controllers' startup is complete and safeties are verified.
 - g. Automatic temperature-control systems are operational.

- h. Ceilings are installed.
- i. Windows and doors are installed.
- j. Suitable access to balancing devices and equipment is provided.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.

- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.
- K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
 - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
 - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
 - 2. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report artificial loading of filters at the time static pressures are measured.
 - 3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 - 4. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 - 5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
 - 1. Measure airflow of submain and branch ducts.
 - 2. Adjust submain and branch duct volume dampers for specified airflow.
 - 3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
 - 1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
 - 2. Measure inlets and outlets airflow.
 - 3. Adjust each inlet and outlet for specified airflow.
 - 4. Re-measure each inlet and outlet after they have been adjusted.
- D. Verify final system conditions.
 - 1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
 - 2. Re-measure and confirm that total airflow is within design.
 - 3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
 - 4. Mark all final settings.
 - 5. Test system in economizer mode. Verify proper operation and adjust if necessary.
 - 6. Measure and record all operating data.
 - 7. Record final fan-performance data.

3.7 PROCEDURES FOR MOTORS

- A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer's name, model number, and serial number.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Phase and hertz.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.

7. Starter size and thermal-protection-element rating.

8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.8 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record fan and motor operating data.

3.9 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify temperature control system is operating within the design limitations.

2. Confirm that the sequences of operation are in compliance with Contract Documents.

3. Verify that controllers are calibrated and function as intended.

4. Verify that controller set points are as indicated.

5. Verify the operation of lockout or interlock systems.

6. Verify the operation of valve and damper actuators.

7. Verify that controlled devices are properly installed and connected to correct controller.

8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.

9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.10 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.

2. Air Outlets and Inlets: Plus or minus 10 percent.

3.11 PROGRESS REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: Prepare progress reports as requested by Architect to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.12 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 - 2. Include a list of instruments used for procedures, along with proof of calibration.
 - 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Fan curves.
 - 2. Manufacturers' test data.
 - 3. Field test reports prepared by system and equipment installers.
 - 4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 - 1. Title page.
 - 2. Name and address of the TAB specialist.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.
 - 7. Contractor's name and address.

8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Data for zone boxes, including manufacturer's name, type, size, and fittings.
 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 15. Test conditions for fan performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Settings for exhaust-air, static-pressure controller.
 - g. Other system operating conditions that affect performance.
- D. Air-Conditioning-Unit Test Reports: For air-conditioning units, include the following:
1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.

- f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Number, make, and size of belts.
 - i. Number, type, and size of filters.
- 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
- 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Filter static-pressure differential in inches wg.
 - e. Outdoor airflow in cfm.
 - f. Return airflow in cfm.
 - g. Outdoor-air damper position.

E. Apparatus-Coil Test Reports:

- 1. Coil Data:
 - a. System identification.
 - b. Number of rows.
 - c. Fin spacing in fins per inch o.c.
- 2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm.
 - b. Average face velocity in fpm.
 - c. Air pressure drop in inches wg.

- d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
 - e. Return-air, wet- and dry-bulb temperatures in deg F.
 - f. Entering-air, wet- and dry-bulb temperatures in deg F.
 - g. Leaving-air, wet- and dry-bulb temperatures in deg F.
- F. Fan Test Reports: For supply, return, and exhaust fans, include the following:
- 1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Number, make, and size of belts.
 - 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.

G. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

- a. System and air-conditioning-unit number.
- b. Location and zone.
- c. Traverse air temperature in deg F.
- d. Duct static pressure in inches wg.
- e. Duct size in inches
- f. Duct area in sq. ft.
- g. Indicated airflow rate in cfm.
- h. Actual airflow rate in cfm.
- i. Actual average velocity in fpm.
- j. Barometric pressure in psig.

H. Instrument Calibration Reports:

1. Report Data:

- a. Instrument type and make.
- b. Serial number.
- c. Application.
- d. Dates of use.
- e. Dates of calibration.

3.13 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager.
- B. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

- D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- E. If TAB work fails, proceed as follows:
 - 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 - 2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
 - 3. If the second verification also fails, Architect may contact AABC Headquarters regarding the AABC National Performance Guaranty.
- F. Prepare test and inspection reports.

3.14 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 07 00

HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes mechanical insulation for duct, equipment, and pipe, including the following:
 - 1. Insulation Materials:
 - a. Mineral-Fiber blanket.
 - 2. Noise Barring Bagging
 - 3. Adhesives.
 - 4. Tapes.
 - 5. Securements.
 - 6. Corner angles.
- B. Related Sections include the following:
 - 1. Division 23 Section "Metal Ducts" for duct liners.

1.2 DEFINITIONS

- A. FSK: Foil, scrim, kraft paper.
- B. FSP: Foil, scrim, polyethylene.
- C. SSL: Self-sealing lap.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Shop Drawings: Show details for the following:
 - 1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 3. Removable insulation at piping specialties, equipment connections, and access panels.
 - 4. Application of field-applied jackets.
 - 5. Application at linkages of control devices.
 - 6. Field application for each equipment type.
- C. Installer Certificates: Signed by Contractor certifying that installers comply with requirements.

- D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- E. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
 1. Products:
 - a. Johns Manville; Microlite.
 - b. Knauf Insulation; Duct Wrap.
 - c. Owens Corning; All-Service Duct Wrap.
 - d. Certainteed Corp.; Soft Touch Duct Wrap.
- F. Noise Barrier wrap: Fire-Resistant, mass-loaded, limp vinyl with a layer of reinforced aluminum foil facing on one side.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Kinetics Noise Control, Inc. (Model KNM-100AL)
 2. Sound Transmission Loss when tested as a free hanging barrier shall be:

Frequency, Hz	63	125	250	500	1000	2000	4000
KNM-100AL	-	13	17	21	28	33	40

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Products:
 - a. Aeroflex USA Inc.; Aero seal.
 - b. Armacell LCC; 520 Adhesive.
 - c. Foster Products Corporation, H. B. Fuller Company; 85-75.
 - d. RBX Corporation; Rubatex Contact Adhesive.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.

2.4 TAPES

- A. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive and UL listed.
 - 1. Products:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - b. Compac Corp.; 120.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
 - d. Venture Tape; 3520 CW.
 - 2. Width: 2 inches.
 - 3. Thickness: 3.7 mils.
 - 4. Adhesion: 100 ounces force/inch in width.
 - 5. Elongation: 5 percent.
 - 6. Tensile Strength: 34 lbf/inch in width.

2.5 SECUREMENTS

- A. Insulation Pins and Hangers:
 - 1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.
 - a. Products:

- 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; CD.
 - 3) Midwest Fasteners, Inc.; CD.
 - 4) Nelson Stud Welding; TPA, TPC, and TPS.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 - a. Products:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; Cupped Head Weld Pin.
 - 3) Midwest Fasteners, Inc.; Cupped Head.
 - 4) Nelson Stud Welding; CHP.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, and securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
 - 2) GEMCO; Perforated Base.
 - 3) Midwest Fasteners, Inc.; Spindle.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Available Products:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, galvanized steel.

1. Manufacturers:

- a. ACS Industries, Inc.
- b. C & F Wire.
- c. Childers Products.
- d. PABCO Metals Corporation.
- e. RPR Products, Inc.

2.6 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- B. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 COMMON INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Firestopping and fire-resistive joint sealers are specified in Division 07 Section "Through-Penetration Firestopping."

3.5 MINERAL-FIBER INSULATION INSTALLATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches (75 mm).
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.

6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 NOISE BARRIER LAGGING INSTALLATION

- A. Where noise barrier wrap is indicated (indicated as shaded on supply ducts), wrap insulated supply ducts with noise barrier in strict accordance with manufacturer's printed installation instructions.
- B. Noise barrier shall be overlapped a minimum of 2 inches on all seams and sealed with acrylic adhesive according to manufacturer's installation instructions.
- C. Metal bands shall be used at 18 inch o.c. spacing to secure barrier in place. Banding shall not compress the underlying fiberglass duct wrap. Use of adhesive tape to hold noise lagging in place is prohibited. Alternatively, pins and washers can be used to impale the lagging in place, as described for mineral-fiber duct wrap installation.

3.7 FINISHES

- A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

3.8 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 1. Supply and return air ducts.
- B. Items Not Insulated:
 1. Fibrous-glass ducts.
 2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 3. Factory-insulated flexible ducts.
 4. Factory-insulated plenums and casings.
 5. Flexible connectors.

6. Vibration-control devices.
7. Factory-insulated access panels and doors.
8. Exposed-to-view ducts within conditioned space they serve.
9. Exhaust ducts.

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Exposed supply, return, outside air and relief ducts located in mechanical rooms:
 1. 2 inch thick duct liner-see Metal Ducts Section.
- B. Concealed supply and return air ducts:
 1. Mineral-Fiber Blanket: 3 inches thick and 0.75-lb/cu. ft. nominal density.
Minimum installed R-Value of 8.0.

**3.10 ABOVEGROUND, OUTDOOR SUPPLY AND RETURN DUCT AND PLENUM
INSULATION SCHEDULE**

- A. 2" thick duct liner- see Metal Ducts section.

END OF SECTION

SECTION 23 09 00

BUILDING AUTOMATION SYSTEM (WIRELESS)

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish a totally native Building Automation System (BAS) by Pelican Wireless Systems, according to the Owner standards.
- B. Provide all necessary wiring, hardware and software to meet the system's functional specifications.
- C. Prepare individual hardware layouts, interconnection drawings, and software configuration from project design data.
- D. Implement the detailed design for all analog and binary objects, system databases, graphic displays, logs, and management reports based on control descriptions, logic drawings, configuration data, and bid documents.
- E. Design, provide, and install all equipment cabinets, panels, wiring and conduit as required, data communication network cables needed, and all associated hardware.
- F. Provide and install all interconnecting cables between supplied cabinets, application controllers, and input/output devices to provide a complete and functional system as noted by the sequence of operations.
- G. Provide complete manufacturer's specifications for all items that are supplied. Include vendor name of every item supplied.
- H. Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, startup, and commissioning.
- I. Provide a comprehensive operator and technician training program as described herein.
- J. Provide as-built documentation, operator's terminal software, diagrams, and all other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.
- K. Provide new sensors, dampers, valves, and install only new components. No used components shall be used as any part or piece of installed system.

1.2 SYSTEM DESCRIPTION

- A. The BAS shall be as indicated on the drawings and described in these specifications. System shall include a network of commercial Internet-programmable thermostats, their accessories, and any other networked devices required for complete climate management. Devices shall communicate across a wireless network using IEEE 802.15.4 technical standards. Wireless communication shall be of an automated mesh

communication type, which self-establishes network addresses, communication routes, and all other setup requirements to establish connection across the entire building. A single Ethernet-connected Gateway shall be able to connect the wireless mesh network to the Internet, allowing for climate management through a cloud based web-application. This network design is to be used to isolate the BAS from the owner's private Ethernet network (LAN) and/or WiFi networks. IEEE 802.11 or any other wireless standard of communication or a wired network communication protocol between devices is not acceptable by these BAS specifications. The Gateway is to connect to a single outbound Ethernet connection on the owner's wide area network (WAN) over a TCP/IP connection. The owner's firewall shall not require any inbound port assignments for the Gateway to connect to the cloud servers. The Gateway shall not require a Public IP and it shall not run any standard available operating systems, such as Windows or Linux.

- B. Access and control of BAS shall be through a web-based graphical management platform. The BAS platform shall sit on a cloud server and be accessible on both local personal computers and remotely by use of a web-browser that supports HTML5 or later.
- C. No on-site servers are to be installed or used for the BAS. No licensing fees or future licensing fees shall be required as part of the BAS. These specifications and guidelines are to create a cohesive and secure network that provides full management over the facility's climate through the cloud BAS.
- D. The BAS shall accommodate an unlimited simultaneous multiple-user operation. Access to the BAS shall be limiting based on security permissions of each operator's role managed by owner site Administrators.

1.3 APPROVED MANUFACTURERS AND INSTALLERS

- A. Pelican Wireless Systems installed by local Pelican authorized installer.

1.4 QUALITY ASSURANCE

- A. The BAS shall be designed, installed, commissioned, and serviced by authorize Pelican installer. System provider shall have an in-place support facility within 2 hours response time of the site with technical staff, spare parts inventory, and necessary test and diagnostic equipment.
 - 1. The Bidder shall be regularly engaged in the design, installation and maintenance of BAS systems and shall have demonstrated technical expertise and experience in the design, installation and maintenance of Pelican Wireless Systems of similar in size and complexity to this project. Bidders shall provide a list of at least 5 projects, similar in size and scope to this project completed within the past 3 years.
- B. Materials and equipment shall be manufacturer's latest standard design that complies with the specification requirements.
- C. All BAS peer-to-peer network controllers, central system controllers and local user displays shall be UL Listed under Standard UL 916, category PAZX.
- D. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference, and be so labeled.

- E. Control system shall be engineered, programmed and supported completely by representative's local office that must be within 100 miles of project site.

1.5 REFERENCE STANDARDS

- A. The latest edition of the following standards and codes in effect and amended as of supplier's proposal date, and any applicable subsections thereof, shall govern design and selection of equipment and material supplied:
 - 1. IEEE 802.15.4 Technical Standard
 - 2. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
 - 3. Title 24, Part 6: 2022 California Building Energy Efficiency Standards.
- B. City, county, state, and federal regulations and codes in effect as of contract date.
- C. Except as otherwise indicated, the system supplier shall secure and pay for all permits, inspections, and certifications required for his work, and arrange for necessary approvals by the governing authorities.

1.6 SUBMITTALS

- A. Drawings
 - 1. The system supplier shall provide a fully complete submittal including point to point engineered drawings, control sequences of operations, bill of materials, and cut sheets for all control devices for approval. Incomplete submittals will be rejected. Partial submittals are not acceptable.
 - 2. Drawings provided in PDF format are acceptable.
- B. System Documentation
 - 1. Include the following in submittal package:
 - a. Floor plan drawings indicating the exact location of all thermostats, repeaters and Pelican panels to ensure wireless connectivity between all buildings on the site.
 - b. Electrical drawings that show all system internal and external connection points, terminal block layouts, and terminal identification.
 - c. Point to point wiring diagrams complete bill of materials, repeaters, combination dry bulb thermostat and CO2 sensors, economizer controllers, power supplies, cabling, interconnecting wiring for DCV and other functions, and all other devices required for a fully functional system.
 - d. Cut sheets of all control devices.

1.7 WARRANTY

- A. The BAS contractor shall warrant the system for 12 months after system acceptance and beneficial use by the owner. During the warranty period, the BAS contractor shall be responsible for all necessary revisions as required to provide a complete and workable system consistent with the letter and intent of the Sequence of Operation section of the

specification. BAS equipment shall include a limited-warranty by the manufacturer for a period of five (5) years from the time of system acceptance.

- B. Limited-warranty by manufacturer is limited to replacement of defective products.

1.8 RELATED WORK IN OTHER SECTIONS

- A. Refer to Division 0 and Division 1 for related contractual requirements.
- B. 230593 Testing, Adjusting, and Balancing for HVAC
- C. 26 00 00 General Electrical Provisions.
- D. 260519 Low Voltage Electrical Power Conductors and Cables
- E. 260523 Control Voltage Electrical Power Cables
- F. 260529 Hangers and Supports for Electrical Systems
- G. 260533 Raceways and Boxes for Electrical Systems

PART 2 - PRODUCTS

2.1 OPERATOR INTERFACE

- A. The BAS shall be controlled, managed, and configured using a Web-App on any personal computer, smartphone, and/or tablet that runs a browser with HTML5 or newer.
- B. The Web-App platform shall run on cloud servers which allow for virtual access. Platform shall not run on a local on-site server.
- C. The Web-App shall support at a minimum, the following functions:
 - a. Personal user log-on identifications (email addresses) and unique passwords shall be required.
 - b. Custom HTML programming shall not be required to display any graphics, data, or build the Web-App. There shall be no development cost, commissioning costs, or software upgrade cost required to obtain and use the Web-App.
 - c. Storage of historical data shall reside on the cloud server and shall not sit within the client's computer, internal network, or other devices. A BAS, which requires on-site data storage, is not acceptable.
 - d. System shall allow for administrator and user defined access privileges.
 - e. A Push/Pull OpenAPI interface with XML data output shall be available.
 - f. Servers shall not run a Windows operating system.
- D. Control and Override
 - a. The BAS shall provide view, override, and edit of the status of any object and property in the system. The status of the device shall be defined graphically and shall not require any custom programs or programming.

- b. Temporary Overrides. The BAS shall be able to provide temporary override (wherever an override is allowed) and automatically remove the override after a specified period of time.
 - c. Any override and edit of a object virtually or at the device, if allowable, shall be historically tracked.
- E. Scheduling
 - a. The BAS shall provide users with scheduling of application devices through a graphical interface. Scheduling shall include, but is not limited to:
 - b. Occupied/Unoccupied Schedules. Shall allow 12 scheduled set-time changes in a single day, be configurable for Daily, Weekly, and Weekday/Weekend layouts, and shall be able to be unique to individual devices or easily shared between multiple devices, where applicable.
 - c. Event Schedules. Shall allow for advanced one-time or repeating event type schedules. Event schedules shall override Occupied/Unoccupied Schedules. After the Event schedule ends, the device shall revert back to the Occupied/Unoccupied Schedule automatically.
 - d. Vacation Schedules. A 360-day Calendar shall provide override of schedules during vacation days. Thermostats shall be able to automatically or be manually switched to follow Vacation Schedules instead of Occupied/Unoccupied Schedules.
- F. Alarm Notification
 - a. Alarm Notification(s) shall be generated if there are failures detected by devices part of the BAS. These failures shall be, but are not limited to temperature deviations, temperatures missing targets, temperatures too high or too low, failures of equipment, etc. Alarm Notification(s) shall be posted on the BAS and shall be able to be sent either via email or text message to an unlimited number of users.
- G. Reports and Logs
 - a. Data shall be logged and stored on cloud servers for all devices part of BAS in real-time. Every device real-time "state change", when applicable, shall be stored and viewable for at least one week, with the option of up to two (2) years.
 - 1) Each space temperature
 - 2) Each temperature set point(s)
 - 3) Each current call: heat, cool, number of stages, fan, economizer, etc.
 - 4) Each damper position
 - 5) Each valve position
 - 6) Each CO² change
 - 7) Each CO² setting
 - 8) Each current call for ventilation due to high CO²
 - 9) Each Humidity change
 - 10) Each Humidity set point
 - 11) Each current call for dehumidification or humidification.
 - 12) Each Fan speed adjustment
 - 13) Supply duct static pressure

- 14) Supply, Return, Outside air temperatures
- 15) Others as requested by the mechanical engineer of record and/or the Commissioning Agent.
- b. Data shall be represented on historical graphs that allow for easy viewing of device state change at different times.
- c. Excel outputs shall not be required to view data. Historical data shall be viewable through BAS.

2.2 APPLICATION SPECIFIC CONTROLLERS

- A. Application Specific Controllers shall not require custom programming and shall control specific equipment through simple configuration settings done through the cloud-based BAS. All configuration changes shall automatically upload into the device once set on the BAS and shall be stored by the device's internal memory.
- B. Gateways are devices which connected to an Ethernet port and act as a bridge between the BAS cloud servers and the wireless mesh network.
 - a. Shall be capable of providing Internet connection to up to 2,000 devices.
 - b. Shall be capable of automatically addressing routing tables to all devices part of wireless mesh network and shall not require manual programming or addressing.
 - c. Shall communicate to cloud servers over a TCP/IP outbound-only connection.
 - d. Shall not require a Public IP address, custom VPNs, or any on-site servers.
 - e. Shall communicate to other BAS devices over the dedicated and isolated 802.15.4 IEEE technical standard.
 - f. Shall be secured using AES (Advanced Encryption Standards).
- C. Internet-Enabled Thermostats are controllers which detect a space/zone temperature and operate equipment or dampers which supply heating, cooling, ventilation, or a combination of the three mechanical states, to their space/zone. Examples are thermostats for VAV, VVT, Fan-Powered Boxes, Fan Coil, Blower Coils, Unit Ventilators, Heat Pumps, Water Source Heat Pumps, and Conventional DX and/or Gas heat equipment.
 - a. Shall be capable of providing 24VAC outputs which can be configured to provide control of the following: two stages of fan, three stages of cooling, two stages of heating, one stage of auxiliary heat (heat pumps), floating point zone dampers, two position zone dampers, floating point zone reheat valves, and two position zone reheat valves.
 - b. Shall include a removable wiring terminal module that allows for thermostat installation even in situations where there are only three wires between equipment and where the thermostat is to be installed.
 - c. Shall be available with the following internal sensors: temperature only, temperature and humidity, temperature, humidity, and CO², and temperature and CO². All sensors required by the specifications are to be internal to the thermostat and not require two devices on the wall.
 - d. Shall be able to accept expansion accessories that allow for more advanced control sequences, and additional temperature detection. Examples are economizer controllers, outside air ventilation control, supply air temperature

- detection, unit ventilator face/bypass control, and modulating control. All expansion accessories shall be Internet enabled and accessible through EMS.
- e. Shall communicate with the wireless mesh network through an internal wireless antenna that runs on the 802.15.4 technical standards.
 - f. Shall be able to automatically repeat the wireless mesh network to additional devices part of the BAS.
 - g. Shall automatically push, in real-time, to the BAS all “state changes” so as to be viewable historically and in real-time from BAS. Examples are changes in equipment operation (heat, cool, fan), number of stages active, the temperatures in the space, damper position, valve position, temperature set-points, etc.
 - h. Shall be able to lock-out heat pump compressor(s) based on outside air temperature.
 - i. Shall provide set-point (heat & cool) temperature limitations through BAS.
 - j. Shall provide full local keypad lock-out from BAS.
 - k. Shall meet California 2022 Title 24 code standards.
 - l. Shall have a programmable three (3°F) degree heat/cool temperature range which auto-adjusts to a five (5°F) degree dead band.
 - m. Shall have both a heat setpoint, cool setpoint, and auto-changeover.
 - n. Shall have Optimum Start algorithms that will calculate start times based on at least seven (7) days of previous run-time temperature and rate-of-change historical data for its space. Optimum Start algorithm shall recalculate each optimized schedule time before each optimized schedule.
 - o. Shall be able to be manually overridden through BAS.
 - p. Shall be configured through BAS.
- D. Wired Temperature Inputs are to be available to provide external temperature detection for specific BAS devices. Examples are to provide supply air temperature, water temperature, refrigeration temperature, outside air temperature, etc. to a thermostat or other device.
- a. Shall accept 10K type II thermistors.
 - b. Shall push to the BAS real-time temperature changes so as to be viewable historically and in real-time from the BAS.
 - c. Shall accept a thermistor at a maximum of up to 100 feet from input terminal.
 - d. Shall be configured through the BAS.
- E. Internet-Enabled Economizer Controller are controllers that modulate an outside air damper to provide ventilation and economization to a single zone.
- a. Shall only require a dry-bulb outside air temperature sensor and dry-bulb supply air temperature sensor. No dry-bulb return air temperature sensor or dry-bulb mixing box temperature sensor shall be required to meet full economizer functionality to at a minimum California 2022 Title 24 standards.
 - b. Shall communicate with thermostat to determine space temperature and space temperature setpoint in order to decide when economization can be used.
 - c. Shall continue to economize as its only source of cooling as long as the outside air temperature is able to keep the space temperature within 1°F of the cooling temperature setpoint.
 - d. Shall be able to enable mechanical cooling at the same time as economization.

- e. Shall be able to prevent the supply air temperature from dropping below a minimum temperature.
 - f. Shall provide enthalpy by use of pulling humidity and barometric pressure information from the Internet based on the zip code of installation location. Enthalpy shall not require any additional probes other than the dry-bulb probe and shall be free to enable.
 - g. If connected to a CO² thermostat, shall be able to provide demand ventilation control of outside air damper.
 - h. Shall have a minimum ventilation damper position and a maximum ventilation damper position.
 - i. Shall be able to be scheduled to not open the outside air damper for ventilation during unoccupied hours.
 - j. Shall be able to control a Variable Frequency Drive (VFD) with up to five (5) fan speed inputs. Example of fan speed changes are during ventilation, stage one cooling, stage two cooling, stage one heating, stage two heating.
 - k. Shall modulate an outside air damper by use of a 0-10VDC signal.
 - l. Shall accept a 0-10VDC signal feedback input from the outside air damper actuator to confirm outside air damper is working correctly.
 - m. Shall meet all California 2022 Title 24 codes, including Fault Detection and Diagnostic requirements.
 - n. Shall send Fault Detection and Diagnostic information to the BAS.
 - o. Shall accept a minimum of three (3) 10K type II thermistors.
 - p. Shall be able to modulate a 0-10VDC hot water, steam, or electric SCR for heating and outside air tempering.
 - q. Shall be able to modulate a 0-10VDC chilled water or modulating DX for cooling and outside air tempering.
 - r. Shall be able to control a face/bypass damper.
 - s. Shall push all "state changes" to the BAS as to be viewable historically and in real-time from BAS. Examples are changes in equipment operation (heat, cool, fan, economization, ventilation), number of stages active, the supply air temperature, the return air temperature, hot water valve position, face/bypass damper position, variable speed fan setting, etc.
 - t. Shall be able to be manually overridden through the BAS.
 - u. Shall be configured through the BAS.
- F. Internet-Enabled Power Relay Module are controllers which have dry-contact relays able to start/stop different electrical equipment. Examples are exhaust fans, lights, pumps, valves, boilers, chillers, etc.
- a. Shall have relays with a max rating of 120 VAC @ 15 AMPs or 240/277 VAC @ 10 AMPs.
 - b. Shall have a low-voltage terminal for momentary contact override inputs. Override time shall be configurable for a specific number of minutes through a configuration from the BAS.
 - c. Shall be able to provide Lead/Lag sequencing between relays.
 - d. Shall be able to accept an external dry-contact input used to verify flow if being used as a pump controller. If being used as a lead/lag pump controller, shall be

- able to alarm the BAS if flow is not detected when Pump A is enabled and start Pump B as a stand-by pump.
- e. Shall communicate with the wireless mesh network through an external wireless antenna that runs on the 802.15.4 technical standards. Antenna shall be able to communicate with Power Relay Module over three (3) 18-gauge wires up to 500 feet between device terminal inputs.
 - f. Shall be able to automatically repeat the wireless mesh network to additional devices part of the BAS.
 - g. Shall push all "state changes" to the BAS as to be viewable historically and in real-time from the BAS. Examples are changes in relay positions On or Off.
 - h. Shall be able to be manually overridden through the BAS.
 - i. Shall be configured through the BAS.
- G. Make-up Air Controllers which operate equipment supplying ventilation to the building.
- a. Shall communicate with the wireless mesh network through a removable wireless antenna that runs on the 802.15.4 technical standards.
 - b. Remote mountable antenna shall be able to communicate to Controller over three (3) 18-gauge wires up to 500 feet between devices terminal inputs.
 - c. Communication from the Controller to zone/space Thermostat(s) shall be over the wireless mesh network.
 - d. Shall be capable of providing 24VAC outputs which can be configured to provide control of the following: multiple stages of fan, multiple stages of cooling, and multiple stages of heating.
 - e. Shall be capable of providing 0-10VDC outputs which can be configured to provide control of the following: modulating variable speed fan (VFD), modulating outside air damper, modulating heating, modulating cooling.
 - f. Shall be able to modulate a VFD to maintain a targeted building static pressure.
 - g. Shall be able to modulate a 0-10VDC hot water, steam, or electric SCR for heating and outside air tempering.
 - h. Shall be able to modulate a 0-10VDC chilled water or modulating DX for cooling and outside air tempering.
 - i. Shall have integrated outside air damper control logic.
 - j. Shall directly accept a building pressure probe. Shall have an integrated short-term and long-term learning PID loop algorithm for maintaining target building pressure. PID loop shall not require any type of cost for programming, is to be factory loaded into controller, and updatable virtually through EMS.
 - k. Shall only require dry-bulb outside and supply air temperature sensors.
 - l. If communicating to CO² thermostat(s), shall be able to provide demand ventilation control of outside air damper.
 - m. Shall push all "state changes" to the BAS as to be viewable historically and in real-time from the BAS. Examples are changes in equipment operation (heat, cool, fan, economization, ventilation), number of stages active, the supply air temperature, the return air temperature, the outside air temperature, hot water valve position, supply duct static reading, variable speed fan setting, etc.
 - n. Shall be scheduled On or Off through the BAS.
 - o. Shall be able to be manually overridden through the BAS.

- p. Shall be configured through the BAS.
- H. Wireless Proximity Sensors are thermostat accessories which are able to detect when a door or window is opened or closed, or be able to accept a dry-contact input from an occupancy sensor.
 - a. Shall be able to communicate to a single Internet-Programmable Thermostat over wireless mesh network.
 - b. Shall communicate with the wireless mesh network through an internal wireless antenna that runs on the 802.15.4 technical standards.
 - c. Shall run on two AA batteries and not require any unique type of battery to operate.
 - d. Shall push all "state changes" to the BAS as to be viewable historically and in real-time from the BAS. Examples are if the door is open, if the space is unoccupied, if a window is open.
 - e. Shall be configured through the BAS.
- I. Remote Wireless Sensors are thermostat accessories which are used to either average temperatures between the sensor location and a master thermostat or to relocate the sensing location of the master thermostat without having to run new wire.
 - a. Shall be able to communicate to a single Internet-Programmable Thermostat over wireless mesh network.
 - b. Shall communicate with the wireless mesh network through an internal wireless antenna that runs on the 802.15.4 technical standards.
 - c. Shall run on two AA batteries and not require any unique type of battery to operate.
 - d. Shall push all "state changes" to the BAS as to be viewable historically and in real-time from the BAS. Examples are changes in equipment operation (heat, cool, fan), number of stages active, the temperatures in the space, temperature set-points, etc.
 - e. Shall be configured through the BAS.
- J. Wireless Repeaters are devices which extend the 802.15.4 wireless mesh network across large expanses or where BAS devices are unable to repeat the wireless mesh network on their own. Examples are when bridging the wireless mesh network from one building to another.
 - a. Shall communicate with the wireless mesh network through an internal wireless antenna that runs on the 802.15.4 technical standards.
 - b. Shall be able to automatically repeat the wireless mesh network to additional devices part of the BAS.
 - c. Shall not require an Ethernet connection or any TCP/IP connection.
 - d. Shall only require a single 120V outlet for power.
- K. Configuration of Devices and System
 - a. To meet the sequence of operation for each controller, the controller shall be configured through the BAS by the installing contractor. No custom programming or downloading by use of a service tool shall be required.

- b. Stand-Alone Operation: Each piece of equipment specified shall provide stand-alone operation. BAS devices shall not require web connection or communication to the BAS to run under normal operations.

2.3 CONTROL ENCLOSURES

- A. All controllers, power supplies and relays shall be mounted in enclosures.
- B. Enclosures may be NEMA 1 when located in a clean, dry, indoor environment. Indoor enclosures shall be NEMA 12 when installed in other than a clean environment.
- C. Enclosures shall be NEMA 4 when located in an outdoor environment.
- D. Enclosures shall have hinged, locking doors.
- E. Provide laminated plastic nameplates for all enclosures in any mechanical room or electrical room. Include location and unit served on nameplate. Laminated plastic shall be 0.125 inches thick and appropriately sized to make label easy to read.

PART 3 - EXECUTION

3.1 Installation

- A. Installation of BAS shall be performed by an approved Contractor. Approved contractor is one whom either has installed the BAS before or has been approved by the BAS manufacturer. The Contractor shall certify all work as proper and complete. Under no circumstance shall the design, scheduling, coordination, programming, training, and warranty requirements for the project be delegated to a subcontractor unless that subcontractor meets the BAS approved Contractor requirements as stated above.

3.2 Examination

- A. Thoroughly examine project plans for control device and equipment locations. Report discrepancies, conflicts, or omissions to Architect or Engineer for resolution before starting rough-in work.
- B. Inspect site to verify that equipment can be installed as shown. Report discrepancies, conflicts, or omissions to Engineer for resolution before starting rough-in work.
- C. Examine drawings and specifications for work of others. Report inadequate headroom or space conditions or other discrepancies to Engineer and obtain written instructions for changes necessary to accommodate Section 230900 work with work of others. BAS Contractor shall perform at his expense necessary changes in specified work caused by failure or neglect to report discrepancies.

3.3 Protection

- A. BAS Contractor shall protect against and be liable for damage to work and to material caused by BAS Contractor's work or employees.
- B. BAS Contractor shall be responsible for work and equipment until inspected, tested, and accepted. Protect material not immediately installed. Close open ends of work with

temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.4 Coordination

A. Site:

1. Assist in coordinating space conditions to accommodate the work of each trade where work will be installed near or will interfere with work of other trades. If installation without coordination causes interference with work of other trades, BAS Contractor shall correct conditions without extra charge.
2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.

B. Test and Balance:

1. Provide Test and Balance Contractor a single set of necessary tools (if needed) to interface to control system for testing and balancing.
2. Train Test and Balance Contractor to use control system interface tools.
3. Provide a qualified technician to assist with testing and balancing the first 20 terminal units.
4. Test and Balance Contractor shall return tools undamaged and in working condition at completion of testing and balancing.

C. Coordination with Other Controls: Integrate with and coordinate controls and control devices furnished or installed by others as follows.

1. Each supplier of a controls product shall configure, program, start up, and test that product to meet the sequences of operation.
2. Coordinate and resolve incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.
3. BAS Contractor shall be responsible for integration of control products provided by multiple suppliers regardless of where integration is described within the contract documents.

3.5 General Workmanship

- A. Install equipment, piping, and wiring or raceway horizontally, vertically, and parallel to walls wherever possible.
- B. Provide sufficient slack and flexible connections to allow for piping and equipment vibration isolation.
- C. Install equipment in accessible locations as defined by National Electrical Code (NEC) Chapter 1 Article 100 Part A.
- D. Verify wiring integrity to ensure continuity and freedom from shorts and ground faults.
- E. Equipment, installation, and wiring shall comply with industry specifications and standards and local codes for performance, reliability, and compatibility.

3.6 Field Quality Control

- A. Work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances as identified in Section 230900 Article 1.5 (Reference Standards).
- B. Continually monitor field installation for code compliance and workmanship quality.
- C. BAS Contractor shall arrange for work inspection by local or state authorities having jurisdiction over the work.

3.7 Wiring

- A. Low voltage (Class 2) wiring in concealed accessible spaces may be plenum rated and is not required to be enclosed in conduit.
- B. Control and interlock wiring and installation shall comply with national and local electrical codes, Division 26, and manufacturer's recommendations. Where the requirements of Section 230900 differ from Division 26, Section 230900 shall take precedence.
- C. NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway as specified by NEC and Division 26.
- D. Low-voltage wiring shall meet NEC Class 2 requirements. Subfuse low-voltage power circuits as required to meet Class 2 current limit.
- E. NEC Class 2 (low voltage current-limited) wires not in raceway but in concealed and accessible locations such as return air plenums shall be UL listed for the intended application.
- F. Conduit: All conduit shall comply with the minimum requirements of the local authority having jurisdiction.
 - 1. Install wiring in conduit where subject to mechanical damage and at levels below 10ft in mechanical, electrical, or service rooms.
 - 2. Install wiring in conduit for wall sensors and extend the conduit 6" above the ceiling. Install a bushing on the end of the conduit.
 - 3. Install wiring in conduit above inaccessible ceilings.
 - 4. Secure conduit with conduit clamps fastened to structure and spaced according to code requirements. Conduit and pull boxes shall not be hung on or attached to ductwork, electrical raceways, piping, or ceiling suspension systems.
 - 5. Size conduit and select wire size and type in accordance with manufacturer's recommendations and NEC requirements.
 - 6. Include one pull string in each conduit 1 in. or larger.
 - 7. Install Class 1 and Class 2 wiring in separate conduits. Boxes and panels containing high-voltage wiring and equipment shall not be used for low-voltage wiring except for the purpose of interfacing the two through relays and transformers.
 - 8. Do not install wiring in conduit containing tubing.
 - 9. Conceal conduit except within mechanical, electrical, or service rooms. Maintain minimum clearance of 6 in. between raceway and high-temperature equipment such as steam pipes or flues.
 - 10. Adhere to requirements in Division 26 where conduit crosses building expansion joints.

11. Flexible metal conduit and liquid-tight flexible metal conduit shall not exceed 3 ft. in length and shall be supported at each end. Do not use flexible metal conduit less than 1/2 inch electrical trade size. Use liquid-tight flexible metal conduits in areas exposed to moisture including chiller and boiler rooms.
 12. Install conduits rigidly, support adequately, ream at both ends, and leave clean and free of obstructions. Join conduit sections with couplings and according to code. Make terminations in boxes with fittings. Make terminations outside of boxes with bushings.
- G. Locate control transmitters, high/low limit switches, status relays, etc., in control panels only. Do not install control and status relays in packaged equipment control panel enclosures containing Class 1 starters.
- H. Field wiring of all safety switches shall be brought back individually to discrete terminals in the control panel. Serial wiring of safeties is not permitted. Where safeties (e.g. freeze-stat) must be mounted in a plenum, the locations shall be clearly described in documents, and clearly field-labelled on access doors as per the diagram designation.
- I. All terminal box controls (controller, power supply, actuators, sensors, pressure ports) shall be field-mounted to permit calibration and service from a single ladder location, coordinated wherever feasible with the furniture layout. Components shall not be installed in a manner that obstructs the factory-provided performance curve data.
- J. Terminate control and interlock wiring related to the work of this section. Maintain at the job site updated (as-built) wiring diagrams that identify terminations.
- K. BAS Contractor shall provide stepdown transformers.

3.8 Installation of Sensors

- A. Install sensors according to manufacturer's recommendations.
- B. Mount sensors rigidly and adequately for operating environment.
- C. Install room temperature sensors on concealed junction boxes properly supported by wall framing. For room sensors located exterior walls, furnish and install a 1/4" thick, adhesive backed, foam insulating pad made by BAPI. Do not place room sensors in direct sunlight.
- D. Air seal wires attached to sensors in their conduits in the wall to prevent sensor readings from being affected by air transmitted from other areas.
- E. Use averaging sensors in mixing plenums and hot and cold decks. Install averaging sensors in a serpentine manner vertically across duct. Support each bend with a capillary clip.
- F. Install mixing plenum low-limit sensors in a serpentine manner horizontally across duct. Support each bend with a capillary clip. Provide 1 ft. of sensing element for each 1 ft 2) of coil area.
- G. Install pipe-mounted temperature sensors in wells. Install liquid temperature sensors with heat-conducting fluid in thermal wells.

- H. Install outdoor air temperature sensors on north wall at designated location with sun shield.
- I. Differential Air Static Pressure:
 - 1. Building Static Pressure: Pipe pressure sensor's low-pressure port to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe high-pressure port to a location behind a thermostat cover.
 - 2. Piping to pressure transducer pressure ports shall contain a capped test port adjacent to transducer.
 - 3. Pressure transducers, except those controlling VAV boxes, shall be located in control panels, not on monitored equipment or on ductwork. Mount transducers in a vibration-free location accessible for service without use of ladders or special equipment.
 - 4. Mount gauge tees adjacent to air and water differential pressure taps. Install shut-off valves before tee for water gauges.
- J. Smoke detectors, freeze stats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Provide contacts that allow BAS software to monitor safety switch status.

3.9 SYSTEM CONFIGURATION

- A. General. The installing contractor shall provide all labor necessary to install, initialize, start-up and troubleshoot all system hardware and configurations described in this section. This includes any requirements necessary to access the web application on third-party devices.
- B. Installing contractor shall work with owner's representative to determine configuration parameters including but not limited to hours of operation, set points, system variables, naming of devices, and site naming. Naming of devices and the site shall be performed by the installing contractor. Naming convention of space thermostats shall be space served. Naming convention of zone controllers shall be the equipment serial number. All naming shall be provided by or agreed upon with the owner.

3.10 SYSTEM COMMISSIONING AND SYSTEM STARTUP

- A. Each BAS component in the system shall be tested for both hardware and software functionality. In addition, each mechanical and electrical system under control of the BAS will be tested against the appropriate sequence of operation specified herein. Documentation shall be provided to the owner that proves installation and testing has been completed and points out any mechanical issues found that are not related to the installation of the BAS. Successful completion of the system tests shall constitute the beginning of the warranty period.
- B. The BAS Contractor shall provide all manpower and engineering services required to assist the HVAC Contractor and Balancing Contractor in testing, adjusting, and balancing all systems in the building. The BAS Contractor shall have a trained technician

available on request during the balancing of the systems. The BAS Contractor shall coordinate all requirements to provide a complete air balance with the Balancing Contractor and shall include all labor and materials in his contract to assist with functional testing of system as it relates to BAS.

- C. Upon completion of installation, submit a PDF copy of record documents. The documents shall be submitted for approval prior to final completion and include:
1. Testing and Commissioning Reports and Checklists signed off by trained field commissioning personnel.
 2. Name, address and telephone number of Contractor personnel managing and installing equipment, along with service personnel responsible for supporting the ongoing warranty and services of the control system.
 3. Procedures for operating the BAS including logging on/off, alarm management, reading reports, trends, modification of setpoints, scheduling, and other interactive system requirements.
 4. Provide information on how to receive support from Pelican Wireless Systems and demonstrate that they are a direct supporting resource. Contact information for Technical Support from Pelican Wireless Systems is to be provided.

3.11 Control System Checkout and Testing

- A. Startup Testing: Complete startup testing to verify operational control system before notifying Owner of system demonstration. Provide Owner with schedule for startup testing. Owner may have representative present during any or all startup testing.
1. Calibrate and prepare for service each instrument, control, and accessory equipment furnished under Division 23.
 2. Verify that control wiring is properly connected and free of shorts and ground faults. Verify that terminations are tight.
 3. Enable control systems and verify each input device's calibration. Calibrate each device according to manufacturer's recommendations.
 4. Verify that binary output devices such as relays, solenoid valves, two-position actuators and control valves, and magnetic starters, operate properly and that normal positions are correct.
 5. Verify that analog output devices such as I/Ps and actuators are functional, that start and span are correct, and that direction and normal positions are correct. Check control valves and automatic dampers to ensure proper action and closure. Make necessary adjustments to valve stem and damper blade travel.
 6. Prepare a log documenting startup testing of each input and output device, with technician's initials certifying each device has been tested and calibrated.
 7. Verify that system operates according to sequences of operation. Simulate and observe each operational mode by overriding and varying inputs and schedules. Tune PID loops and each control routine that requires tuning.
 8. Alarms and Interlocks:
 - a. Check each alarm with an appropriate signal at a value that will trip the alarm.
 - b. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction.

- c. Test interlock actions by simulating alarm conditions to check initiating value of variable and interlock action.

3.12 Control System Demonstration and Acceptance

- A. Demonstration: Prior to acceptance, perform the following performance tests to demonstrate system operation and compliance with specification after and in addition to tests specified in Section 3.11 (Control System Checkout and Testing). Furnish log documenting completion of startup tests.
 - 1. Demonstration shall follow process submitted and approved under Submittals section of this specification. Complete approved checklists and forms for each system as part of system demonstration.
 - 2. Demonstrate actual field operation of each sequence of operation. Provide at least two persons equipped with two-way communication. Demonstrate calibration and response of any input and output points requested by Owner's representative. Provide and operate test equipment required to prove proper system operation.
 - 3. Demonstrate compliance with System Performance section of this specification.
 - 4. Demonstrate compliance with sequences of operation through each operational mode.
 - 5. Demonstrate complete operation of operator interface.
 - 6. Demonstrate each of the following:
 - a. Furnish trend logs for each system: Trend data shall indicate setpoints, operating points, valve positions, and other data as specified in the points list provided with each sequence of operation in. Each log shall cover three 7-day periods and shall have a sample frequency not more than 5 minutes. Logs shall be accessible through system's operator interface.
 - 7. Tests that fail to demonstrate proper system operation shall be repeated after BAS Contractor makes necessary repairs or revisions to hardware or software to successfully complete each test.

3.13 Cleaning

- A. Each day clean up debris resulting from work. Remove packaging material as soon as its contents have been removed. Collect waste and place in designated location.
- B. On completion of work in each area, clean work debris and equipment. Keep areas free from dust, dirt, and debris.
- C. On completion of work, check equipment furnished under this section for paint damage. Repair damaged factory-finished paint to match adjacent areas. Replace deformed cabinets and enclosures with new material and repaint to match adjacent areas.

3.14 AS-BUILT DOCUMENTATION

- A. Project Record Documents. Submit three copies of record (as-built) documents upon completion of installation for approval prior to final completion. Submittal shall consist of:
 - 1. Project Record Drawings of as-built versions of submittal Shop Drawings provided in electronic PDF format. As-built floor plans indicating the routing of mstp communication wiring shall be included.

2. Testing and commissioning reports and checklists of completed final versions of reports, checklists, and trend logs.
3. As-built versions of submittal Product Data.
4. Names, addresses, e-mail addresses and 24-hour telephone numbers of Installer and service representatives for DDC system and products.
5. Operator's manual with procedures for operating control systems including logging on and off, handling alarms, producing point reports, trending data, overriding computer control and changing set points and variables.
6. Programming manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
7. Engineering, installation, and maintenance manuals that explain how to:
8. Design and install new points, panels, and other hardware.
9. Perform preventive maintenance and calibration.
10. Debug hardware problems.
11. Repair or replace hardware.
12. Documentation of all programs created using custom programming language including set points, tuning parameters, and object database.
13. Backup copy of graphic files, programs, and database on electronic media such as DVDs.
14. List of recommended spare parts with part numbers and suppliers.
15. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
16. Complete original-issue copies of furnished software, including operating systems, custom programming language, BAS software, and graphics software.
17. Licenses, guarantees, and warranty documents.
18. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
19. Owner training materials.

3.15 Training

- A. Provide 8 hours of training for a designated staff of Owner's representatives. Training shall be provided via self-paced training, web-based or computer-based training, classroom training, or a combination of training methods.
- B. Training shall enable students to accomplish the following objectives:
 1. Proficiently operate system
 2. Understand control system architecture and configuration
 3. Understand DDC system components
 4. Understand system operation, including DDC system control and optimizing routines (algorithms)
 5. Operate workstation and peripherals
 6. Log on and off system
 7. Access graphics, point reports, and logs
 8. Adjust and change system setpoints, time schedules, and holiday schedules
 9. Recognize common HVAC system malfunctions by observing system graphics, trend graphs, and other system tools
 10. Understand system drawings and Operation and Maintenance manual
 11. Understand job layout and location of control components
 12. Access data from DDC controllers

- 13. Operate portable operator's terminals
- 14. Create and change system graphics

- C. Provide course outline and materials according to Section 230900 (Submittals). Provide one copy of training material per student.

- D. Instructors shall be factory-trained and experienced in presenting this material and shall present according to a pre-written curriculum.

- E. Perform classroom training using a network of working controllers, representative of installed hardware.

- F. Record training sessions on digital video for future use by the Owner.

END OF SECTION

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, 07, 08 and 23 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Section 07 84 00 – Firestopping.
 - 2. Section 07 92 00 – Joint Sealants.
 - 3. Section 08 31 00 – Access Doors and Panels.
 - 4. Section 23 05 29 – Hangers and Supports for HVAC.
 - 5. Section 23 05 53 – Identification for HVAC Piping and Equipment.
 - 6. Section 23 09 00 – Instrumentation and Control for HVAC.

1.2 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications.

1.3 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
 - 1. Suction Lines for Air-Conditioning Applications: 300 psig.
 - 2. Suction Lines for Heat-Pump Applications: 535 psig.
 - 3. Hot-Gas and Liquid Lines: 535 psig.

1.4 SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:
 - 1. Thermostatic expansion valves.
 - 2. Solenoid valves.
 - 3. Hot-gas bypass valves.
 - 4. Filter dryers.
 - 5. Strainers.
 - 6. Pressure-regulating valves.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1. Shop Drawing Scale: 1/4 inch equals 1 foot.
2. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

C. Welding certificates.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.6 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.7 COORDINATION

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type K.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Brazing Filler Metals: AWS A5.8.

E. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.

4. Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.2 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:

1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
3. Operator: Rising stem and hand wheel.
4. Seat: Nylon.
5. End Connections: Socket, union, or flanged.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

B. Packed-Angle Valves:

1. Body and Bonnet: Forged brass or cast bronze.
2. Packing: Molded stem, back seating, and replaceable under pressure.
3. Operator: Rising stem.
4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
5. Seal Cap: Forged-brass or valox hex cap.
6. End Connections: Socket, union, threaded, or flanged.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

C. Check Valves:

1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
3. Piston: Removable polytetrafluoroethylene seat.
4. Closing Spring: Stainless steel.
5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
6. End Connections: Socket, union, threaded, or flanged.
7. Maximum Opening Pressure: 0.50 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 275 deg F.

D. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

E. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.

1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.

4. End Connections: Threaded.
 5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with ½ inch conduit adapter.
 6. Working Pressure Rating: 500 psig.
 7. Maximum Operating Temperature: 275 deg F.
 8. Manual operator.
- F. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
 2. Piston, Closing Spring, and Seat Insert: Stainless steel.
 3. Seat Disc: Polytetrafluoroethylene.
 4. End Connections: Threaded.
 5. Working Pressure Rating: 500 psig.
 6. Maximum Operating Temperature: 275 deg F.
- G. Thermostatic Expansion Valves: Comply with ARI 750.
1. Body, Bonnet, and Seal Cap: Forged brass or steel.
 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 3. Packing and Gaskets: Non-asbestos.
 4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
 5. Reverse-flow option (for heat-pump applications).
 6. End Connections: Socket, flare, or threaded union.
 7. Working Pressure Rating: 500 psig.
- H. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.
1. Body, Bonnet, and Seal Cap: Ductile iron or steel.
 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 3. Packing and Gaskets: Non-asbestos.
 4. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
 5. Seat: Polytetrafluoroethylene.
 6. Equalizer: as recommended by manufacturer.
 7. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with ½ inch conduit adapter, and coil.
 8. End Connections: Socket.
 9. Set Pressure: as recommended by manufacturer.
 10. Throttling Range: as recommended by manufacturer.
 11. Working Pressure Rating: 500 psig.
 12. Maximum Operating Temperature: 240 deg F.
- I. Straight-Type Strainers:
1. Body: Welded steel with corrosion-resistant coating.
 2. Screen: 100-mesh stainless steel.
 3. End Connections: Socket or flare.
 4. Working Pressure Rating: 500 psig.
 5. Maximum Operating Temperature: 275 deg F.
- J. Angle-Type Strainers:

1. Body: Forged brass or cast bronze.
2. Drain Plug: Brass hex plug.
3. Screen: 100-mesh monel.
4. End Connections: Socket or flare.
5. Working Pressure Rating: 500 psig.
6. Maximum Operating Temperature: 275 deg F.

K. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

L. Permanent Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Rated Flow: as per equipment manufacturer.
9. Working Pressure Rating: 500 psig.
10. Maximum Operating Temperature: 240 deg F.

M. Mufflers:

1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or flare.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

N. Receivers: Comply with ARI 495.

1. Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
2. Comply with UL 207; listed and labeled by an NRTL.
3. Body: Welded steel with corrosion-resistant coating.
4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
5. End Connections: Socket or threaded.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

O. Liquid Accumulators: Comply with ARI 495.

1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or threaded.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

2.3 REFRIGERANTS

A. Manufacturers:

1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

B. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction Lines NPS 1 ½ (DN40) and Smaller. Copper, Type K(A) annealed-temper tubing and wrought-copper fittings with brazed joints.
- B. Suction Lines NPS 2 to NPS 3 ½ (DN 50 to DN90). Copper, Type K(A), drawn-temper tubing and wrought-copper fittings with brazed joints.
- C. Suction Lines NPS 4 (DN 100). Copper, Type K(A) drawn temper tubing and wrought-copper fittings with brazed joints.
- D. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper Type K(A), annealed-or drawn-temper tubing and wrought-copper fittings with brazed joints.
- E. Safety relief valve discharge piping: Copper, type K(A) annealed or drawn temper tubing and wrought copper fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

- A. Install diaphragm packless valves in suction and discharge lines of compressor.
- B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.
- C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
- D. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.
- E. Install a full-sized, three-valve bypass around filter dryers.

- F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.
- G. Install thermostatic expansion valves as close as possible to distributors on evaporators.
 - 1. Install valve so diaphragm case is warmer than bulb.
 - 2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
 - 3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- H. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.
- I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
- J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:
 - 1. Solenoid valves.
 - 2. Thermostatic expansion valves.
 - 3. Hot-gas bypass valves.
 - 4. Compressor.
- K. Install filter dryers in liquid line between compressor and thermostatic expansion valve and in the suction line at the compressor.
- L. Install receivers sized to accommodate pump-down charge.

3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.

- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Refer to Sections 230900 - Instrumentation and Control for HVAC and Section 230993 -Sequence of Operation for solenoid valve controllers, control wiring, and sequence of operation.
- K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 08 31 00 - Access Doors and Panels if valves or equipment requiring maintenance is concealed behind finished surfaces.
- M. Install refrigerant piping in protective conduit where installed belowground.
- N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- O. Slope refrigerant piping as follows:
 - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 - 2. Install horizontal suction lines with a uniform slope downward to compressor.
 - 3. Install traps and double risers to entrain oil in vertical runs.
 - 4. Liquid lines may be installed level.
- P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- Q. Before installation of steel refrigerant piping, clean pipe and fittings using the following procedures:
 - 1. Shot blast the interior of piping.
 - 2. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through tubing by means of a wire or electrician's tape.
 - 3. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
 - 4. Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.
 - 5. Finally, draw a clean, dry, lintless cloth through the tube or pipe.
 - 6. Safety-relief-valve discharge piping is not required to be cleaned but is required to be open to allow unrestricted flow.

- R. Install pipe sleeves at penetrations in exterior walls and floor assemblies.
- S. Seal penetrations through fire and smoke barriers according to Section 07 84 00 - "Fire Stopping."
- T. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- U. Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.
- V. Seal pipe penetrations through exterior walls according to Section 07 92 00 - Joint Sealants for materials and methods.
- W. Identify refrigerant piping and valves according to Section 23 05 53 - Identification for HVAC Piping and Equipment.

3.4 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.
- D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 - 1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
 - 2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.
- F. Threaded Joints: Thread steel pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Steel pipe can be threaded, but threaded joints must be seal brazed or seal welded.
- H. Welded Joints: Construct joints according to AWS D10.12/D10.12M.

- I. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.5 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Section 230529 - Hangers and Supports for HVAC Piping and Equipment.
- B. Install the following pipe attachments:
 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
 2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 4. Spring hangers to support vertical runs.
 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
 1. NPS ½ inch: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 5. NPS 1 ½ inch: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 7. NPS 2½ inch: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 9. NPS 4: Maximum span, 12 feet; minimum rod size, ½ inch.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 1. Comply with ASME B31.5, Chapter VI.
 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.

- d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

- A. Charge system using the following procedures:
 - 1. Install core in filter dryers after leak test but before evacuation.
 - 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
 - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
 - 4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
 - 1. Open shutoff valves in condenser water circuit.
 - 2. Verify that compressor oil level is correct.
 - 3. Open compressor suction and discharge valves.
 - 4. Open refrigerant valves except bypass valves that are used for other purposes.
 - 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core or replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION

SECTION 23 31 13

METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Double-wall rectangular ducts and fittings.
3. Single-wall round and flat oval ducts and fittings.
4. Double-wall round and flat oval ducts and fittings.
5. Sheet metal materials.
6. Duct liner.
7. Sealants and gaskets.
8. Hangers and supports.
9. Seismic-restraint devices.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
 1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
 2. Seismic Hazard Level B: Seismic force to weight ratio, 0.30.
 3. Seismic Hazard Level C: Seismic force to weight ratio, 0.15.
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

D. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.

- c. Speakers.
- d. Sprinklers.
- e. Access panels.
- f. Perimeter moldings.

E. Welding certificates.

F. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. McGill AirFlow LLC.
 - b. SEMCO Incorporated.
- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 1. Transverse Joints in Ducts Larger Than 60 inches in Diameter: Flanged.
- D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
- E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 1. Galvanized Coating Designation: G60.
 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 1. Galvanized Coating Designation: G60.

2. Minimum Thickness for Factory-Applied PVC Coating: 4 mils thick on sheet metal surface of ducts and fittings exposed to corrosive conditions, and minimum 1 mil thick on opposite surface.
 3. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL 181, Class 1.
- D. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- E. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- F. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- G. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- H. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. CertainTeed Corporation; Insulation Group.
 - b. Johns Manville.
 - c. Knauf Insulation.
 - d. Owens Corning.
- 1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - 2) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

4. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Insulation Pins and Washers:
 1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
 1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
 3. Butt transverse joints without gaps, and coat joint with adhesive.
 4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
 5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
 6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
 7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
 8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.
 - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
 9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

- a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
10. Terminate inner ducts with build outs attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated build outs (metal hat sections) or other build out means are optional; when used, secure build outs to duct walls with bolts, screws, rivets, or welds.

2.5 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 2. Tape Width: 4 inches.
 3. Sealant: Modified styrene acrylic.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 7. Service: Indoor and outdoor.
 8. Service Temperature: Minus 40 to plus 200 deg F.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
 10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Water-Based Joint and Seam Sealant:
 1. Application Method: Brush on.
 2. Solids Content: Minimum 65 percent.
 3. Shore A Hardness: Minimum 20.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. VOC: Maximum 75 g/L (less water).
 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 8. Service: Indoor or outdoor.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Solvent-Based Joint and Seam Sealant:
 1. Application Method: Brush on.
 2. Base: Synthetic rubber resin.

3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L.
10. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
11. Maximum Static-Pressure Class: 10-inch wg , positive or negative.
12. Service: Indoor or outdoor.
13. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

G. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 , "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.7 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hilti Corp.
 - 2. Mason Industries.
 - 3. TOLCO; a brand of NIBCO INC.
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
 - 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
- D. Restraint Cables: ASTM A 603, galvanized-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.
- E. Hanger Rod Stiffener: Steel support systems to hanger rod.
- F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round and flat oval ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Outdoor, Supply-Air Ducts: Seal Class A.
 - 3. Outdoor, Exhaust Ducts: Seal Class C.
 - 4. Outdoor, Return-Air Ducts: Seal Class C.
 - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
 - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
 - 7. Unconditioned Space, Exhaust Ducts: Seal Class C.
 - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
 - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
 - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
 - 11. Conditioned Space, Exhaust Ducts: Seal Class B.
 - 12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
- B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install cable restraints on ducts that are suspended with vibration isolators.
- E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.
- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.
- G. Drilling for and Setting Anchors:
 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.6 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 2. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 3. Test for leaks before applying external insulation.
 4. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
 5. Give seven days' advance notice for testing.
- C. Duct System Cleanliness Tests:
 1. Visually inspect duct system to ensure that no visible contaminants are present.
 2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.9 DUCT CLEANING

- A. Clean new and existing duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
 - 1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
 - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 - 3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:
 - 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
 - 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- D. Clean the following components by removing surface contaminants and deposits:
 - 1. Air outlets and inlets (registers, grilles, and diffusers).
 - 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 - 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 - 4. Coils and related components.
 - 5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
 - 6. Supply-air ducts, dampers, actuators, and turning vanes.
 - 7. Dedicated exhaust and ventilation components and makeup air systems.
- E. Mechanical Cleaning Methodology:
 - 1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
 - 2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 - 3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
 - 4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.

5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.10 START UP

- A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel.
- B. Supply Ducts:
 1. Ducts Connected to gas/electric A.C. units:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 24.
- C. Return Ducts:
 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units :
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 24.
- D. Exhaust Ducts:
 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 24.
 2. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.
 - a. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.
 - b. Concealed: Type 304, stainless-steel sheet, No. 2D finish.
 - c. Welded seams and joints.
 - d. Pressure Class: Positive or negative 3-inch wg.

- e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
- f. SMACNA Leakage Class: 3.

E. Intermediate Reinforcement:

- 1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.
- 2. PVC-Coated Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Match duct material.
- 3. Stainless-Steel Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Match duct material.
- 4. Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.

F. Liner:

- 1. Supply Air Ducts: Flexible elastomeric, 2 inches thick.
- 2. Return Air Ducts: Flexible elastomeric, 2 inches thick.
- 3. Supply Fan Plenums: Flexible elastomeric, 2 inches thick.
- 4. Return- and Exhaust-Fan Plenums: Flexible elastomeric, 2 inches thick.

G. Elbow Configuration:

- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm :
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

- 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm: Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Barometric relief dampers.
3. Manual volume dampers.
4. Control dampers.
5. Fire dampers.
6. Combination fire and smoke dampers.
7. Flange connectors.
8. Turning vanes.
9. Remote damper operators.
10. Duct-mounted access doors.
11. Flexible connectors.
12. Flexible ducts.
13. Duct accessory hardware.
14. Duct silencers.

B. Related Sections:

1. Division 23 Section "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
2. Division 28 Section "Fire Detection and Alarm" for duct-mounted fire and smoke detectors.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
 - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control damper installations.
 - d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
 - e. Duct security bars.
 - f. Wiring Diagrams: For power, signal, and control wiring.
- C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
- D. Source quality-control reports.
- E. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

1.5 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - EXECUTION

2.1 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: [G60] [G90].
 - 2. Exposed-Surface Finish: Mill phosphatized.
- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304.
- D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches .

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. Greenheck Fan Corporation.
 - 3. Pottorff; a division of PCI Industries, Inc.
 - 4. Ruskin Company.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 2000 fpm.
- D. Maximum System Pressure: 2-inch wg.
- E. Frame: 0.052-inch- thick, galvanized sheet steel, with welded corners.

- F. Blades: Multiple single-piece blades, maximum 6-inch width, 0.025-inch-thick, roll-formed aluminum with sealed edges.
- G. Blade Action: Parallel.
- H. Blade Seals: Extruded vinyl, mechanically locked or Neoprene, mechanically locked.
- I. Blade Axles:
 - 1. Material: Galvanized steel.
 - 2. Diameter: 0.20 inch.
- J. Tie Bars and Brackets: Galvanized steel.
- K. Return Spring: Adjustable tension.
- L. Accessories:
 - 1. Adjustment device to permit setting for varying differential static pressure.
 - 2. Counterweights and spring-assist kits for vertical airflow installations.
 - 3. Electric actuators.
 - 4. Chain pulls.
 - 5. Screen Mounting: Front mounted in sleeve.
 - a. Sleeve Thickness: 20-gage minimum.
 - b. Sleeve Length: 6 inches minimum.
 - 6. Screen Mounting: Rear mounted.
 - 7. Screen Material: Galvanized steel.
 - 8. Screen Type: Bird.
 - 9. 90-degree stops.

2.3 BAROMETRIC RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. Greenheck Fan Corporation.
 - 3. Pottorff; a division of PCI Industries, Inc.
 - 4. Ruskin Company.

- B. Suitable for horizontal or vertical mounting.
- C. Maximum Air Velocity: 2000 fpm.
- D. Maximum System Pressure: 2-inch wg.
- E. Frame: 0.064-inch- thick, galvanized sheet steel, with welded corners.
- F. Blades:
 - 1. Multiple, 0.025-inch-thick, roll-formed aluminum.
 - 2. Maximum Width: 6 inches.
 - 3. Action: Parallel.
 - 4. Balance: Gravity.
 - 5. Eccentrically pivoted.
- G. Blade Seals: Vinyl or Neoprene.
- H. Blade Axles: Galvanized steel.
- I. Tie Bars and Brackets:
 - 1. Material: Galvanized steel.
 - 2. Rattle free with 90-degree stop.
- J. Return Spring: Adjustable tension.
- K. Accessories:
 - 1. Flange on intake.
 - 2. Adjustment device to permit setting for varying differential static pressures.

2.4 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. Pottorff; a division of PCI Industries, Inc.
 - c. Ruskin Company.
 - 2. Standard leakage rating, with linkage outside airstream.

3. Suitable for horizontal or vertical applications.
 4. Frames:
 - a. Hat-shaped, galvanized, 0.064-inch minimum thickness.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 0.064 inch thick.
 6. Blade Axles: Galvanized steel.
 7. Bearings:
 - a. Oil-impregnated bronze.
 - b. Dampers in ducts with pressure classes of 3-inch wg. or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 8. Tie Bars and Brackets: Galvanized steel.
- B. Low-Leakage, Steel, Manual Volume Dampers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. Pottorff; a division of PCI Industries, Inc.
 - c. Ruskin Company.
 2. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
 3. Suitable for horizontal or vertical applications.
 4. Frames:
 - a. Hat shaped.
 - b. Galvanized-steel channels, 0.064 inch thick.

- c. Mitered and welded corners.
 - d. Flanges for attaching to walls and flangeless frames for installing in ducts.
- 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized, roll-formed steel, 0.064 inch thick.
- 6. Blade Axles: Galvanized.
- 7. Bearings:
 - a. Oil-impregnated bronze.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
- 8. Blade Seals: Vinyl or Neoprene.
- 9. Jamb Seals: Cambered stainless steel.
- 10. Tie Bars and Brackets: Galvanized steel.
- 11. Accessories:
 - a. Include locking device to hold single-blade dampers in a fixed position without vibration.
- C. Jackshaft:
 - 1. Size: 1-inch diameter.
 - 2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - 3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- D. Damper Hardware:
 - 1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
 - 2. Include center hole to suit damper operating-rod size.
 - 3. Include elevated platform for insulated duct mounting.

2.5 CONTROL DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Warming and Ventilating; a division of Mestek, Inc.
 - 2. Greenheck Fan Corporation.
 - 3. Ruskin Company.
- B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
- C. Frames:
 - 1. Hat shaped.
 - 2. Galvanized-steel channels, 0.064 inch thick.
 - 3. Mitered and welded corners.
- D. Blades:
 - 1. Multiple blade with maximum blade width of 8 inches.
 - 2. Opposed-blade design.
 - 3. Galvanized steel.
 - 4. 0.064 inch thick.
 - 5. Blade Edging: Closed-cell neoprene edging.
 - 6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.
- E. Blade Axles: 1/2-inch-diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
 - 1. Operating Temperature Range: From minus 40 to plus 200 deg F.
- F. Bearings:
 - 1. Oil-impregnated bronze.
 - 2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 3. Thrust bearings at each end of every blade.

2.6 FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Pottorff; a division of PCI Industries, Inc.
 - 3. Ruskin Company.
- B. Type: Fire dampers shall be labeled according to UL 555 by an NRTL.
- C. Fire Rating: 1-1/2 or 3 hours.
- D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.
- E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
 - 1. Minimum Thickness: 0.052 or 0.138 inch thick, as indicated, and of length to suit application.
 - 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- F. Mounting Orientation: Vertical or horizontal as indicated.
- G. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- I. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.7 COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Greenheck Fan Corporation.
 - 2. Pottorff
 - 3. Ruskin Company.
- B. Combination fire and smoke dampers shall be labeled according to UL 555 and UL 555S by an NRTL.
- C. Fire Rating: 1-1/2 or 3 hours.

- D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- E. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.
- F. Heat-Responsive Device: Electric resettable link and switch package, factory installed, rated.
- G. Smoke Detector: Integral, factory wired for single-point connection.
- H. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- I. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- J. Leakage: Class I.
- K. Rated pressure and velocity to exceed design airflow conditions.
- L. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application.
- M. Master control panel for use in dynamic smoke-management systems.
- N. Damper Motors: Modulating and two-position action.
- O. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
 - 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf .
 - 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
 - 6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf .

7. Electrical Connection: 115 V, single phase, 60 Hz.

2.8 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Ductmate Industries, Inc.
 2. Nexus PDQ; Division of Shilco Holdings Inc.
 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.9 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Ductmate Industries, Inc.
 2. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- E. Vane Construction: Double wall.
- F. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.10 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Greenheck Fan Corporation.
 - 3. Pottorff; a division of PCI Industries, Inc.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
 - 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
 - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
 - d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.11 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. Ventfabrics, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.

- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd. .
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 24 oz./sq. yd. .
 - 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
 - 3. Service Temperature: Minus 50 to plus 250 deg. F.
- G. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.
 - 1. Minimum Weight: 16 oz./sq. yd.
 - 2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
 - 3. Service Temperature: Minus 67 to plus 500 deg. F.
- H. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.
 - 1. Minimum Weight: 14 oz./sq. yd.
 - 2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
 - 3. Service Temperature: Minus 67 to plus 500 deg. F.
- I. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
 - 1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
 - 2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.12 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Casco Silentflex II.
- B. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
 1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
 2. Maximum Air Velocity: 4000 fpm.
 3. Temperature Range: Minus 20 to plus 175 deg F.
 4. Insulation R-Value: Comply with Title 24.

2.13 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.14 DUCT SILENCER

- A. Manufacturers:
 1. Vibro-Acoustics.
 2. Industrial Acoustics Company (IAC)
 3. Commercial Acoustics.
- B. General Description: Factory-fabricated and -tested, round or rectangular silencers with performance characteristics and physical requirements as indicated.

- C. Fire Performance: Adhesives, sealants, packing materials, and accessory materials shall have fire ratings not exceeding 25 for flame-spread index and 50 for smoke-developed index when tested according to ASTM E 84.
- D. Rectangular Units: Fabricate casings with a minimum of 0.034-inch- thick, solid galvanized sheet metal for outer casing and 0.022-inch- thick, ASTM A 653/A 653M, G60, perforated galvanized sheet metal for inner casing.
- E. Round Units:
 - 1. Outer Casings:
 - a. ASTM A 653/A 653M, G60, galvanized sheet steel.
 - b. Up to 24 Inches in Diameter: 0.034 inch thick.
 - c. 26 through 40 Inches in Diameter: 0.040 inch thick.
 - d. 42 through 52 Inches in Diameter: 0.052 inch thick.
 - e. 54 through 60 Inches in Diameter: 0.064 inch thick.
 - f. Casings fabricated of spiral lock-seam duct may be one size thinner than that indicated.
 - 2. Interior Casing, Partitions, and Baffles:
 - a. ASTM A 653/A 653M, G60, galvanized sheet steel.
 - b. At least 0.034 inch thick and designed for minimum aerodynamic losses.
- F. Sheet Metal Perforations: 1/8-inch diameter for inner casing and baffle sheet metal.
- G. Fill Material: Inert and vermin-proof fibrous material, packed under not less than 5 percent compression.
 - 1. Erosion Barrier: Polymer bag enclosing fill and heat-sealed before assembly.
- H. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations.
 - 1. Do not use nuts, bolts, or sheet metal screws for unit assemblies.
 - 2. Lock form and seal or continuously weld joints.
 - 3. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
 - 4. Reinforcement: Cross or trapeze angles for rigid suspension.
- I. Source Quality Control:
 - 1. Acoustic Performance: Test according to ASTM E 477.

2. Record acoustic ratings, including dynamic insertion loss and self-noise power levels with an airflow of at least 2000-fpm face velocity.
3. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg static pressure, whichever is greater.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 1. Install steel volume dampers in steel ducts.
 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing.
- H. Connect ducts to duct silencers with flexible duct connectors.
- I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 1. On both sides of duct coils.
 2. Downstream from duct filters.
 3. At outdoor-air intakes and mixed-air plenums.
 4. At drain pans and seals.
 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.

6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 7. At each change in direction and at maximum 50-foot spacing.
 8. Downstream from turning vanes.
 9. Upstream or downstream from duct silencers.
 10. Control devices requiring inspection.
 11. Elsewhere as indicated.
- J. Install access doors with swing against duct static pressure.
- K. Access Door Sizes:
1. One-Hand or Inspection Access: 8 by 5 inches.
 2. Two-Hand Access: 12 by 6 inches.
 3. Head and Hand Access: 18 by 10 inches.
 4. Head and Shoulders Access: 21 by 14 inches.
 5. Body Access: 25 by 14 inches.
 6. Body plus Ladder Access: 25 by 17 inches.
- L. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- M. Install flexible connectors to connect ducts to equipment.
- N. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- O. Connect terminal units to supply ducts directly or with maximum 84-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- P. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- Q. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.
- R. Install duct test holes where required for testing and balancing purposes.

- S. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.
- T. All equipment and components requiring access above hardlid ceiling shall be provided with adequate service clearance and ceiling access panels. Coordinate ceiling access panel location based upon installation location in field and in accordance with Section 08 31 00 – Access Doors and Panels.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

- 1. Operate dampers to verify full range of movement.
- 2. Inspect locations of access doors and verify that purpose of access door can be performed.
- 3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
- 4. Inspect turning vanes for proper and secure installation.
- 5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

SECTION 23 34 23

HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Roof mounted ventilators.
 - 2. Ceiling mounted ventilators.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on actual Project site elevations.
- B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material thickness and finishes, including color charts.
 - 5. Dampers, including housings, linkages, and operators.
 - 6. Roof curbs.
 - 7. Fan speed controllers.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated-Design Submittal: For unit hangars and supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- D. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - 1. Roof framing and support members relative to duct penetrations.
 - 2. Ceiling suspension assembly members.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- E. Field quality-control reports.
- F. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.
- C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.
- D. Fan shall be manufactured at an ISO 9001 certified facility.

1.6 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided.
- C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.7 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 ROOF MOUNTED VENTILATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Loren Cook Company.
3. Twin City

B. Description: Fan shall be a spun-aluminum, dome top, roof mounted, belt driven, downblast centrifugal exhaust ventilator construction: The aluminum base shall have a one-piece inlet spinning and continuously welded curb cap corners for maximum leak protection. The wind band shall have a rolled bead for added strength.

C. Wheels: Aluminum hub and wheel with backward inclined blades.

2.2 CEILING-MOUNTED VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Loren Cook Company.
3. Twin City

B. These units are factory assembled with one or more centrifugal wheels up to 12 inches wide, directly connected to motor, enclosed in housing, with inlet grille and integral backdraft damper; AMCA rated.

C. Housing: Steel, lined with acoustical insulation.

D. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

E. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.

F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

G. Accessories:

H. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

1. Manufacturer's standard roof cap, curb, and transition fittings.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

- B. Enclosure Type: Totally enclosed, fan cooled.

2.4 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch. Vibration-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- C. Install units with clearances for service and maintenance.
- D. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Connect wiring and ground equipment according to Division 26.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Verify that shipping, blocking, and bracing are removed.

2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 3. Verify that cleaning and adjusting are complete.
 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 5. Adjust belt tension.
 6. Adjust damper linkages for proper damper operation.
 7. Verify lubrication for bearings and other moving parts.
 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 10. Shut unit down and reconnect automatic temperature-control operators.
 11. Remove and replace malfunctioning units and retest as specified above.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION

SECTION 23 37 13

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, 08 and 23 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Section 08 91 19 - Louvers.
 - 2. Section 23 33 00 – Air Duct Accessories

1.2 SUMMARY

- A. Section Includes:
 - 1. Rectangular and square ceiling diffusers.
 - 2. Perforated diffusers.
 - 3. Louver face diffusers.
 - 4. Adjustable bar registers and grilles.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.
- C. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.
- D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - 1. Ceiling suspension assembly members.
 - 2. Method of attaching hangers to building structure.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 5. Duct access panels.

- E. Source quality-control reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 GRILLES AND REGISTERS

- A. Adjustable Sidewall Supply:

- 1. Product: Price 520
- 2. Manufacturers:
 - a. Price Industries.
 - b. Titus.
 - c. Anemostat; a Mestek Company.
- 3. Steel supply grilles shall be of the sizes and mounting types shown on the plans and outlet schedule. The deflection blades shall be available parallel to the long or short dimension of the grille. Construction shall be of steel with a 1-1/4 inch wide border on all sides. Screw holes shall be countersunk for a neat appearance. Corner shall be welded with full penetration resistance welds.
- 4. Deflection blades shall be contoured to a specifically designed and tested cross-section to meet published test performance data. Blades shall be spaced on 3/4-inch centers. Blades shall have steel friction pivots on both ends to allow individual blade adjustment without loosening or rattling. Plastic blade pivots are not acceptable.
- 5. The manufacturer shall provide published performance data for the grille. The grille shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

- B. Sidewall Return and Exhaust Register:

- 1. Product: Price 530
- 2. Manufacturers:
 - a. Price Industries.
 - b. Titus.
 - c. Anemostat; a Mestek Company.
- 3. The fixed deflection blades shall be available parallel to the long or short dimension of the grille. Construction shall be of steel with a 1-1/4-inch wide border on all sides. Screw holes shall be countersunk for a neat appearance. Corners shall be welded with full penetration resistance welds.

4. Deflection blades shall be contoured to a specifically designed and tested cross-section to meet published test performance data. Blades shall be firmly held in place by mullions from behind the grille and fixed to the grille by welding in place. Blade deflection angle shall be available at 35°.
5. The grille finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315° F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering, or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.
6. The manufacturer shall provide published performance data for the grille. The grille shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

2.3 CEILING DIFFUSER OUTLETS & INLETS

A. Adjustable Square Cone Diffusers:

1. Product: Price SCDA.
2. Manufacturers:
 - a. Anemostat; a Mestek Company.
 - b. Price Industries.
 - c. Titus.
3. Provide 24" x 24" modular face size at accessible ceiling areas. Use 16" x 16" modular face size for hard ceiling application. Provide suitable mounting/border to ceiling system. Provide face accessible opposed blade damper for all diffusers located in hard ceiling.
4. The finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H.
5. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering, or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.
6. The manufacturer shall provide published performance data for the perforated diffuser. The diffuser shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.

- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 23 74 13

PACKAGED OUTDOOR ROOFTOP AC UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes packaged, outdoor, rooftop units with the following components and accessories:
 - 1. Direct-expansion cooling.
 - 2. Heat pump.
 - 3. Economizer outdoor- and return-air damper section.
 - 4. Integral, space temperature controls.

1.3 DEFINITIONS

- A. DDC: Direct-digital controls.
- B. ECM: Electrically commutated motor.
- C. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
- D. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
- E. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.
- F. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.
- G. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during

heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

1.4 SUBMITTALS

- A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Manufacturer Wind Loading Qualification Certification: Submit certification that specified equipment will withstand wind forces identified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Coordination Drawings: Plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Structural members to which RTUs will be attached.
 - 2. Roof openings
 - 3. Roof curbs and flashing.
 - 4. Building Management Control System (BMCS)
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.
- G. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. ARI Compliance:

1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
 2. Comply with ARI 270 for testing and rating sound performance for RTUs.
 - B. ASHRAE Compliance:
 1. Comply with ASHRAE 15 for refrigeration system safety.
 2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
 3. Comply with applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment", Section 5.5 "Mold Resistance of Airstream Surfaces", Section 5.6 "Location of Outside Air Intakes", Section 5.11 "Design of Condensate Pans", and Section 7 - "Construction and Startup."
 - C. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."
 - D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B for flame spread and smoke generation.
 - E. UL Compliance: Comply with UL 1995.
 - F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - G. Unit shall be Energy Star certified. (3 tons and larger)
 - H. Roof curb shall be designed to conform to NRCA Standards.
 - I. Unit casing shall be capable of withstanding Federal test method Standard No. 141 (Method 6061) 500-hour salt spray test. (3 tons and larger)
 - J. Units shall be designed and manufactured in a facility registered by ISO.
 - K. Units shall be run tested on the factory assembly line in both cooling and heating modes.
- 1.6 WARRANTY
- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.
 1. Warranty Period for Compressors: Minimum 5 years from date of Substantial Completion.
 2. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Substantial Completion.

3. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Fan Belts: One set for each belt-driven fan.
 2. Filters: One set of filters for each unit.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Unit(s) shall be stored and handled per manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Trane.
 2. Carrier.
 3. York.
- B. Basis of Design is Trane. If contractor submits on listed alternates, he shall assume monetary and logistical responsibility for any and all necessary structural, electrical, plumbing, architectural and HVAC modifications. Contractor shall also compensate the Architect of Record (AOR) and Mechanical Engineer of Record (MEOR) for efforts related to updating energy compliance calculations.

2.2 PACKAGED ROOFTOP HEAT PUMP UNIT

A. SYSTEM DESCRIPTION

1. Factory-assembled, single-piece Outdoor rooftop, or slab-mounted, electrically controlled heating and cooling unit. Include all factory wiring, piping, controls, refrigerant charge (R-4154b), and fully hermetic scroll compressor. Unit shall discharge supply air vertically as shown on contract drawings.

B. UNIT CABINET:

1. Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a baked enamel finish on all externally exposed surfaces, and have primer-coated interior panels.

2. Evaporator-fan cabinet interior shall be insulated with a minimum .5-in. thick, 1 lb. density, and flexible fiberglass insulation. Insulation shall conform to AHRI 210/240 or 340/360 minimum exterior sweat criteria. Gas heat compartment shall use aluminum foil face fiberglass insulation.
3. Cabinet panels shall be easily removable for servicing, and shall have molded composite handles.
4. Holes shall be provided in the base rails for rigging shackles to facilitate overhead rigging, and forklift slots shall be provided to facilitate maneuvering.
5. Unit shall have a factory-installed, sloped condensate drain pan made of a non-corrosive material, providing a minimum 3/4-in. connection with both vertical and horizontal drains and shall comply with ASHRAE 62.
6. Unit shall have factory-installed filter access panel to provide filter access with tool-less removal.

C. FANS:

1. Indoor blower shall be of the belt-driven, double inlet, forward-curved centrifugal type. Belt drive shall include an adjustable-pitch motor pulley.
2. Indoor blower shall be made from steel with a corrosion-resistant finish and shall be dynamically balanced.
3. Bearings shall be of the sealed, permanently lubricated, ball-bearing type.
4. Condenser fan shall be of the direct-driven propeller type and shall discharge air vertically upward.
5. Condenser fan shall have aluminum blades riveted to corrosion-resistant steel spiders and shall be dynamically balanced.
6. Condenser-fan motor shall be energy-efficient type.
7. Induced draft blower shall be of the direct-driven, single inlet, forward curved type made from steel with a corrosion-resistant finish.

D. COMPRESSORS:

1. Fully hermetic scroll type, internally protected, with crankcase heater.
2. Two compressors for two stage capacity control.
3. Factory rubber-shock mounted and internally spring mounted for vibration isolation.

E. COILS:

1. Provide standard evaporator and condenser coils shall have aluminum plate fins mechanically bonded to enhanced copper tubes with all joints brazed, with factory

flexible epoxy polymer coating (E-COAT) on indoor and outdoor coils. Coating process shall ensure complete coil encapsulation of tubes, fins and headers. Corrosion durability shall be confirmed through testing to be no less than 1000 hours salt spray per ASTM B117-90.

F. REFRIGERANT COMPONENTS:

1. Thermostatic Expansion Valve shall be standard.
2. Service gage connections on suction and liquid lines. Include a gauge line access port in the top of the RTU to facilitate correct and accurate condenser pressure readings with the access panels in place.
3. Filter drier.

G. FILTER SECTION:

1. Standard filter section shall consist of factory-installed 2-inch low-velocity, throwaway filters of the same size.
2. Filter face velocity shall not exceed 300 fpm at nominal airflow.
3. Filter section shall use only one size filter.
4. Filters shall be accessible through an access panel with "no-tool required" removal capability.
5. Factory-installed filters are for start-up only, and will be replaced with pleated filters of the type and rating as shown on the equipment schedule. Filters are to be furnished and installed by the contractor.

H. CONTROLS:

1. Shall be complete with self-contained low-voltage control circuit protected by a fuse on the 24V transformer side.
2. Low ambient controls down to 35 F. ambient shall be standard and shall not require the installation of a field-installed heat pressure control package.
3. Unit shall include an Integrated Staging Control (ISC) that is intended for use with a standard thermostat or direct digital control. LED lights shall indicate if the unit is running properly or not. The configuration of red lights will indicate the type of error that the board has identified.
4. Provide standard electro-mechanical unit controls without EMS interface. EMS communications card, and thermostat for OTHER EMS, to be furnished and installed by the controls contractor.

I. SAFETIES (COOLING):

1. Compressor over-temperature, over-current, high-pressure differential.

2. Loss-of-charge/low-pressure switch.
3. Automatic reset, motor thermal overload protector.
4. High-pressure switch.

J. OPERATING CHARACTERISTICS:

1. Unit shall be capable of starting and running at 125 F ambient outdoor temperature.
2. Compressor with standard controls shall be capable of operation down to 40 F ambient outdoor temperature.
3. All unit power wiring shall enter unit cabinet at a single factory pre-drilled location.

K. MOTORS:

1. Compressor motors shall be cooled by refrigerant passing through motor windings and shall have line break thermal and current overload protection.
2. Evaporator Fan Motor shall be a high efficiency multi-speed ECM motor.
3. Indoor blower (evaporator-fan) motor shall have permanently lubricated bearings and inherent automatic-reset thermal overload protection.
4. Condenser-fan motor shall have permanently lubricated bearings and inherent automatic-reset thermal overload protection.
5. Induced draft motor shall have permanently lubricated, sealed bearings and inherent automatic reset thermal overload protection.

L. CONDENSATE PAN:

1. Internally sloped pan made of non-corrosive material with 3/4" drain connections on side or bottom of pan. ASHRAE 62 compliant.

M. SPECIAL FEATURES:

1. VIBRATION ISOLATION ROOF CURB:

- a. Refer to contract drawings for applicability. 16 gauge formed galvanized steel capable of supporting entire unit weight. Supply and return air openings shall be as shown on the contract drawings. Curb shall be structurally-calculated and meet the seismic requirements of the current California Building Code (CBC). Include calculations signed and stamped by a licensed California structural engineer. Provide unit hold-downs.
- b. Curb shall be provided with Factory acoustical option.
- c. Curb shall be 21 inches tall.

- d. Allow for installing and securing ductwork to curb prior to mounting unit on the curb.
- 2. CONTROLS:
 - a. Provide units with factory BACnet controller.
- 3. INTEGRATED ECONOMIZER:
 - a. Provide fully modulating microprocessor-controlled gear-driven economizer with barometric relief. Economizer shall be of low-leak design, conform to ASHRAE 90.1, and have a maximum leakage rate equal to 4.0 cfm/sq. ft. @ 1.0 in. w.g. Factory assembled, designed to relieve 100% of the return air in order to maintain proper building pressure. Include 100% shut-down on loss of power and barometric relief damper. All fan motors shall be UL certified. Capable of sensing outdoor-air enthalpy content (temperature and humidity) and controlling economizer cut-in point to have minimum heat content air passing over the evaporator coil for most efficient system operation.
 - b. Provide with 100% barometric relief as specified on contract drawings.
 - c. Economizer actuator shall be by Belimo, model TFB24-SR.
 - d. Provide 100% modulating power exhaust assembly as specified on the contract drawings. Provide space pressure tubing as required. Tubing shall terminate in the ceiling of the space which the unit serves. Provide chrome escutcheon at tubing ceiling termination.
 - e. Economizer/power exhaust module shall mount directly on the air conditioning unit. Remote power exhaust will not be accepted.
- 4. CONDENSER COIL GUARD GRILLE:
 - a. Louvered grille designed to protect the condenser coil from damage by vandalism or flying debris while not inhibiting unit clearances or serviceability.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.
- B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
- C. Examine roofs for suitable conditions where RTUs will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. **Roof Curb:** Install on roof structure, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Division 07 Section "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.
- B. **Unit Support:** Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.

3.3 CONNECTIONS

- A. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
- B. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
 - 1. Install ducts to termination at top of roof curb.
 - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
 - 3. Connect supply ducts to RTUs with flexible duct connectors specified in Division 23 Section "Air Duct Accessories."
 - 4. Install return-air duct continuously through roof structure.

3.4 FIELD QUALITY CONTROL

- A. **Manufacturer's Field Service:** Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. **Perform tests and inspections and prepare test reports.**
 - 1. **Manufacturer's Field Service:** Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.
- C. **Tests and Inspections:**
 - 1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
 - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 3. **Operational Test:** After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to compressor, coils, and fans.
3. Inspect internal insulation.
4. Verify that labels are clearly visible.
5. Verify that clearances have been provided for servicing.
6. Verify that controls are connected and operable.
7. Verify that filters are installed.
8. Clean condenser coil and inspect for construction debris.
9. Remove packing from vibration isolators.
10. Inspect operation of barometric relief dampers.
11. Verify lubrication on fan and motor bearings.
12. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
13. Adjust fan belts to proper alignment and tension.
14. Start unit according to manufacturer's written instructions.
 - a. Start refrigeration system.
 - b. Do not operate below recommended low-ambient temperature.
 - c. Complete startup sheets and attach copy with Contractor's startup report.
15. Inspect and record performance of interlocks and protective devices; verify sequences.
16. Operate unit for an initial period as recommended or required by manufacturer.
17. Calibrate thermostats.

18. Adjust and inspect high-temperature limits.
19. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
20. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:
 - a. Coil leaving-air, dry- and wet-bulb temperatures.
 - b. Coil entering-air, dry- and wet-bulb temperatures.
 - c. Outdoor-air, dry-bulb temperature.
 - d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
21. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
22. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
 - a. Supply-air volume.
 - b. Return-air volume.
 - c. Relief-air volume.
 - d. Outdoor-air intake volume.
23. Simulate maximum cooling demand and inspect the following:
 - a. Compressor refrigerant suction and hot-gas pressures.
 - b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.
24. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.6 CLEANING AND ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.
- B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 23 81 23

DUCTLESS SPLIT SYSTEM AIR CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Wall mount split system air conditioners.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Electrical-room air conditioners shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For electrical-room air conditioners. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Color Samples: For unit cabinet, discharge grille, and exterior louver and for each color and texture specified.
- D. Coordination Drawings: Plans, elevations, and other details, drawn to scale, using input from Installers of the items involved.
- E. Seismic Qualification Certificates: For electrical-room air conditioners, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Field quality-control reports.

G. Operation and Maintenance Data: For electrical-room air conditioners to include in emergency, operation, and maintenance manuals.

H. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.

D. ASME Compliance: Fabricate and label water-cooled condenser shell to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

1.6 COORDINATION

A. Coordinate layout and installation of electrical-room air conditioners and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electrical-room air conditioners that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Humidifiers: Manufacturer's standard, but not less than three years from date of Substantial Completion.

3. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

1.8 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Fan Belts: One set(s) for each belt-driven fan.
 2. Filters: One set(s) of filters for each unit.

PART 2 - PRODUCTS

2.1 DUCTLESS SPLIT SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Mitsubishi.
 2. Toshiba-Carrier.
 3. LG.
- B. Description: Outdoor-mounted, air-cooled split system outdoor section suitable for on-the-ground, rooftop, wall hung, balcony, or under-deck installation. Unit shall consist of a hermetic compressor, an air-cooled coil, propeller-type condenser fan, and a control box. Unit shall discharge air horizontally as shown on the contract drawings. Units shall function as the outdoor component of an air-to air cooling system.
- C. Standard Features
 1. Unit will be rated in accordance with the latest edition of ARI Standard 210.
 2. Unit will be certified for capacity and efficiency, and listed in the latest ARI directory.
 3. Unit construction will comply with latest edition of ANSI/ASHRAE and with NEC.
 4. Unit will be constructed in accordance with UL standards and will carry the UL label of approval. Unit will have c-UL approval.
 5. Unit cabinet shall be capable of withstanding Federal Test Standard No. 141 (method 6061) 500-hour salt spray test.
 6. Air-cooled condenser coils will be leak tested and pressure tested.
 7. Unit constructed in ISO9001 approved facility.
 8. Unit shall be rated per ARI Standards 210/240 and listed in the ARI directory as a matched system.
- D. Delivery, Storage, and Handling: Unit(s) shall be stored and handled per manufacturer's recommendations.

2.2 OUTDOOR CONDENSING UNIT

- A. PRODUCTS

1. General: Factory assembled, single piece, air-cooled outdoor unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, compressor, refrigerant charge (R-454B), and special features required prior to field start-up.
2. Unit Cabinet: Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a powder coat paint.
3. Fans:
 - a. Outdoor fans shall be direct-drive propeller type, and shall discharge air horizontally. Fans shall blow air through the outdoor coil.
 - b. Outdoor fan motors shall be totally enclosed, single-phase motors with class B insulation and permanently lubricated bearings. Shafts will be corrosion resistant.
 - c. Shaft shall have inherent corrosion resistance.
 - d. Fan blades shall be corrosion resistant and shall be statically and dynamically balanced.
 - e. Outdoor fan openings will be equipped with coated steel wire safety guards.
4. Compressor: Compressor will be hermetically sealed rotary type.
 - a. Compressor assembly shall be installed on rubber vibration isolators.
 - b. Compressors shall be single-phase as specified on the contract drawings.
5. Outdoor Coil:
 - a. Coil shall be constructed of aluminum fins mechanically bonded to internally enhanced, seamless copper tubes, which are cleaned, dehydrated, and sealed.
 - b. Apply Luvata® Insitu, or equal, protective coating. Shall be a spray-applied, low VOC, synthetic, water-based coating embedded with 316 stainless steel to all coil surface areas, Coating shall be flexible when cured and have a dry film thickness of 1.-2. mils of thickness and resistant to cracking due to thermodynamic expansion and contraction.
 - c. Coating shall be compliant with EPA standards and registered with the SCAQMD as an environmentally sustainable single part water based coating, registered and permitted with local EPA air management agencies for use as a HVAC protective coating product.
 - d. Application company shall be fully permitted, licensed and can demonstrate an association with United Technologies Corporation for a period longer than 5 years and show a history of workmanship compliance excellence with the manufacture of such equipment specified.
 - e. Coating applicator shall prove to be in business and financially solvent for a period exceeding the specified warranty of 5 years.
 - f. Coating shall have superior hardness characteristics per ASTM D3363-92A and a crosshatch adhesion of 4B-5B per ASTM B3359-93. Humidity and water immersion resistance shall be up to a minimum of 1000 hours (ASTM D2247).
 - g. Polymer coating will meet ASTM requirements in relation to microbial contamination as per G-21 and D-3273 testing protocol.
 - h. Corrosion durability shall be confirmed through testing of no less than 5,000 hours salt spray per ASTM B117-90.
 - i. 5-year written and submitted conditional warranties mandatory for project.

6. Refrigeration Components:
 - a. Refrigeration circuit components will include liquid-line front-seating shut-off valve with sweat connections, vapor-line front seating shutoff valve with sweat connections, accumulator, system charge of (R-454B) refrigerant, and compressor oil.
 - b. Unit will be equipped with high-pressure switch, low pressure switch and filter drier for refrigerant.
7. Controls and Safeties:
 - a. Operating controls and safeties shall be factory selected, assembled, and tested. The minimum control functions shall include the following:
8. Controls:
 - a. Time delay restart to prevent compressor reverse rotation on single-phase scroll compressors.
 - b. Automatic restart on power failure.
 - c. Safety lockout if any outdoor unit safety is open.
 - d. A time delay control sequence provided through the fan coil board, thermostat, or controller.
 - e. Liquid line low-pressure switches.
 - f. Automatic outdoor-fan motor protection.
9. Safeties:
 - a. System diagnostics.
 - b. Compressor motor current and temperature overload protection.
 - c. High-pressure relief.
 - d. Outdoor fan failure protection.
10. Electrical Requirements:
 - a. Units shall operate on single-phase, 60-cycle power at 208V as specified.
 - b. Unit electrical power shall be a single point connection.
 - c. All power and control wiring must be installed per NEC and all local building codes.
11. Special Features (Field Installed):
 - a. Low-Ambient Kit: Control shall regulate fan-motor cycles in response to saturated condensing, pressure of the unit. The control shall be capable of maintaining a condensing temperature of 100 F with outdoor temperatures to -20 F. Installation of kit shall not require changing the outdoor-fan motor.
 - b. Crankcase Heater: An electric resistance heater which mounts to the base of the compressor to keep the lubricant warm during off cycles. A crankcase heater is required for low ambient operation.
 - c. Wind Baffle Kit: Field-installed accessory kit used with horizontal discharge outdoor condensing units to provide improved unit operation in areas with high winds.

2.3 DUCTLESS HIGH-WALL MOUNTED FAN COIL

- A. **SYSTEM DESCRIPTION:** Indoor, wall-mounted, direct-expansion fan coil matched with a cooling only outdoor unit.
- B. **STANDARD FEATURES:** Unit shall be rated per ARI Standards 210/240 and listed in the ARI directory as a matched system.
- C. **DELIVERY, STORAGE, AND HANDLING:** Unit(s) shall be stored and handled per manufacturer's recommendations.
- D. **PRODUCTS**
 - 1. **GENERAL:** Indoor, direct-expansion, wall-mounted fan coil. Unit shall be complete with cooling/heating coil, fan, fan motor, piping connectors, electrical controls, microprocessor control system, and integral temperature sensing. Unit shall be furnished with integral wall mounting bracket and mounting hardware.
- E. **UNIT CABINET:** Cabinet discharge and inlet grilles shall be attractively styled, high-impact polystyrene. Cabinet shall be fully insulated for improved thermal and acoustic performance.
- F. **Fans:** Fan shall be tangential direct-drive blower type with air intake at the top of the unit and discharge at the bottom front. Automatic, motor-driven vertical air sweep shall be provided standard. Air sweep operation shall be user selectable. The vertical sweep may be adjusted (using the remote control) and the horizontal air direction may be set manually.
- G. **Coil:** Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion. A drip pan under the coil shall have a drain connection for hose attachment to remove condensate. Condensate pan shall have internal trap.
- H. **Motor:** overload protection. Fan motors shall be 3-speed.
- I. **Controls:** Controls shall consist of a microprocessor-based control system which shall control space temperature, determine optimum fan speed, and run self-diagnostics. The temperature control range shall be from 62 deg F to 84 deg F. The unit shall have the following functions as a minimum:
 - 1. An automatic restart after power failure at the same operating conditions as at failure.
 - 2. A timer function to provide a minimum 24-hour timer cycle for system Auto Start/Stop.
 - 3. Indoor coil freeze protection.
 - 4. Wireless infrared remote control to enter set points and operating conditions.
 - 5. Automatic air sweep control to provide on or off activation of air sweep louvers.
 - 6. Fan-only operation to provide room air circulation when no cooling is required.
 - 7. Fan speed control shall be user-selectable: high, medium, low, or microprocessor controlled automatic operation during all operating modes.
- J. **Filters:** Unit shall have filter track with factory-supplied cleanable filters.

- K. Refrigerant Lines: All units should have refrigerant lines that can be oriented to connect from the left, right or back of the unit. Both refrigerant lines need to be insulated.
- L. Power Requirements: Unit main power is supplied to the outdoor unit. Contractor shall supply 4-wire connecting cable to supply power to the indoor unit. For 9K and 12K units, all four wires are low voltage DC. For 18K and 24K units, two wires are high voltage AC power, one is low voltage DC, and one is ground wire.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for hydronic piping systems to verify actual locations of piping connections before equipment installation.
- C. Examine walls, floors, and roofs for suitable conditions where electrical-room air conditioners will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Water and Drainage Connections: Comply with applicable requirements in Division 22 Section "Domestic Water Piping." Provide adequate connections for water-cooled units, condensate drain, and humidifier flushing system.
- D. Hot-Water Heating Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping." Provide shutoff valves in inlet and outlet piping to heating coils.
- E. Steam and Condensate Piping: Comply with applicable requirements in Division 23 Section "Steam and Condensate Heating Piping." Provide shutoff valves in steam inlet and steam trap in condensate outlet piping to heating coils.
- F. Condenser-Water Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping." Provide shutoff valves in water inlet and outlet piping on water-cooled units.
- G. Refrigerant Piping: Comply with applicable requirements in Division 23 Section "Refrigerant Piping." Provide shutoff valves and piping.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 2. After installing electrical-room air conditioners and after electrical circuitry has been energized, test for compliance with requirements.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Electrical-room air conditioners will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.
- F. After startup service and performance test, change filters and flush humidifier.

3.4 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain electrical-room air conditioners.

END OF SECTION

SECTION 26 00 00

GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This specification shall apply to all phases of Work hereinafter specified, shown on Drawings, or as required to provide a complete installation of electrical systems for this Project. Work required under this specification is not limited to just the Electrical Drawings - refer to Architectural, Structural, Landscape, and Mechanical/Plumbing Drawings, as well as all other drawings applicable to this project, which designate the scope of work to be accomplished. The intent of the Drawings and Specifications is to provide a complete and operable electrical system that includes all documents that are a part of the Contract.
 - 1. Work Included: Furnish labor, material, services and skilled supervision necessary for the construction, erection, installation, connections, testing, and adjustment of all circuits and electrical equipment specified herein, or shown or noted on Drawings, and its delivery to the Owner complete in all respects ready for use.
 - 2. The electrical Work includes installation or connection of certain materials and equipment furnished by others. Verify installation details, installation and rough-in locations from the actual equipment or from the equipment shop drawings.
- B. Electrical Drawings: Electrical Drawings are diagrammatic, and are intended to convey the scope of work, indicating intended general arrangement of equipment, conduit and outlets. Follow Drawings in laying out Work and verify spaces for installation of materials and equipment based on actual dimensions of equipment furnished.

1.2 QUALITY ASSURANCE

- A. Design, manufacture, testing and method of installation of all apparatus and materials furnished under requirements of these specifications shall conform to latest publications or standard rules of the following:
 - 1. Institute of Electrical and Electronic Engineers - IEEE
 - 2. National Electrical Manufacturers' Association - NEMA
 - 3. Underwriters' Laboratories, Inc. - UL
 - 4. National Fire Protection Association - NFPA
 - 5. Federal Specifications - Fed. Spec.
 - 6. American Society for Testing and Materials - ASTM

7. American National Standards Institute - ANSI
8. National Electrical Code - NEC
9. National Electrical Safety Code - NESC
10. Insulated Cable Engineers Association - ICEA
11. American Institute of Steel Construction - AISC
12. State and Municipal Codes In Force In The Specific Project Area
13. Occupational Safety and Health Administration (OSHA)
14. Electronics Industries Association/Telecommunications Industry Association (EIA/TIA)
15. California Electrical Code (where adopted)
16. Local Authority Having Jurisdiction (AHJ) Published Electrical Standards and Codes

- B. Perform Work in accordance with the National Electrical Code, applicable building ordinances, and other applicable codes, hereinafter referred to as the "Code." The Contractor shall comply with the Code including local amendments and interpretations without added cost to the Owner. Where Contract Documents exceed minimum requirements, the Contract Documents take precedence. Where code conflicts occur, the most stringent shall apply unless variance is approved.
1. Comply with all requirements for permits, licenses, fees and codes. The Contractor, at Contractor's expense, shall obtain all permits, licenses, fees, special service costs, inspections and arrangements required for Work under this contract, unless otherwise specified.
 2. Comply with requirements of the applicable utility companies serving this Project. Make all arrangements with utility companies for proper coordination of Work.

1.3 GENERAL REQUIREMENTS

- A. Guarantee: Furnish a written guarantee for a period of (1) one-year from date of acceptance.
- B. Wherever a discrepancy in quantity or size of conduit, wire, equipment, devices, circuit breakers, etc., (all materials), arises on the Drawing and/or Specifications, the Contractor shall be responsible for providing and installing all material and services required by the strictest condition noted on Drawings and/or in Specifications to ensure complete and operable systems as required by the Owner and Engineer.
- C. All Core Cutting, Drilling, and Patching:

1. For the installation of work under this Section, the aforementioned shall be performed under this Section of the Specifications and the Concrete section of the Specifications.
2. No holes will be allowed in any structural members without the written approval of the Project's Structural Engineer.
3. For penetrations of concrete slabs or concrete footings, the work shall be as directed in the Concrete Section of Specifications.
4. The Contractor shall be responsible for patching and repairing surfaces where he is required to penetrate for work under this contract.
5. Penetrations shall be sealed to meet the rated integrity of the surface required to be patched and repaired. The patched surface shall be painted or finished to match the existing surface.

D. Verifying Drawings and Job Conditions:

1. The Contractor shall examine all Drawings and Specifications in a manner to be fully cognizant of all work required under this Section.
2. The Contractor shall visit the site and verify existing conditions. Where existing conditions differ from Drawings, adjustment(s) shall be made and allowances included for all necessary equipment to complete all parts of the Drawings and Specifications.

1.4 WORK IN COOPERATION WITH OTHER TRADES

- A. Examine the Drawings and Specifications and determine the work to be performed by the electrical, mechanical and other trades. Provide the type and amount of electrical materials and equipment necessary to place this work in proper operation, completely wired, tested and ready for use. This shall include all conduit, wire, disconnects, relays, and other devices for the required operation sequence of all electrical, mechanical and other systems or equipment.
- B. Provide a conduit-only system for low voltage wiring required for control of mechanical and plumbing equipment described in this or other parts of the Contract Documents. Install all control housings, conduits, and backboxes required for installing conductors to the controls.
- C. Install separate conduits between each heating, ventilating and air conditioning sensing device and its control panel and/or control motor. Before installing any conduit for heating, ventilating and air conditioning control wiring, verify the exact requirements from the control diagrams provided with the equipment manufacturer's shop drawings.

1.5 TESTING AND ADJUSTMENT

- A. Upon completion of all electrical work, the Contractor shall test all circuits, switches, light fixtures, lighting control and dimming systems including distributed systems,

UPSs, generators, SPDs, lighting inverters, transfer switches, motors, circuit breakers, motor starters and their auxiliary circuits and any other electrical items to ensure perfect operation of all electrical equipment.

- B. Equipment and parts in need of correction and discovered during such testing, shall be immediately repaired or replaced with all new equipment and that part of the system shall then be retested. All such replacement or repair shall be done at no additional cost to the Owner.
- C. All circuit(s) shall be tested for continuity and circuit integrity. Adjustments shall be made for circuits not complying with testing criteria.
- D. All test reports, including copies of any required Energy Code Acceptance Forms (e.g. CA Title 24 Acceptance for Code Compliance Forms) should be submitted to the Engineer at completion of project.

1.6 IDENTIFICATION

- A. Nameplates shall be provided for unit substations, switchgear, switchboards, distribution boards, distribution panels, panel boards, motor control centers, transformers, transfer switches, contactors, starters, disconnect switches, enclosed circuit breakers/switches, inverters, UPSs, PDUs, RDCs, SPDs, lighting control panels, dimming panels, door releasing system panels, fire alarm/central monitoring terminal cabinets/power supplies/control panels, and all low voltage system terminal and control cabinets.
 - 1. Nameplate inscriptions shall be identical to the equipment designations indicated in plans and specifications. Nameplates shall be engraved with the device designation/identification on the top line, source identification for the device on the 2nd line per NEC, or CEC where adopted, Art 408.4 and load designation for the device on the bottom line. Where load designation consists of a branch circuit, omit bottom line. Where device designation is not indicated on plans/specifications, Contractor shall submit a written clarification request to the Engineer.
 - a. Example: Transformer 1TA
 - b. Source Disconnecting Location: Switchboard MSA located in Rm 110
 - c. Load: Panels 1LA and 1 LB
 - 2. All circuit breakers/fuses in switchgear, switchboards, distribution boards, distribution panels, UPS output circuit breakers, PDU sub-feed circuit breakers and motor control centers shall have individual nameplates located immediately adjacent to the respective device. Nameplate inscription shall identify the downstream equipment or device served by the circuit breaker or fuse.
- B. Identification nameplates, UON, shall be laminated/extruded modified acrylic that is 3/32" thick, UV-stabilized, matte finish, suitable for use in 180 deg. F ambient, with beveled edges and engraved white letters 3/8" high, minimum, on 1-1/2" high black background (utility/normal and optional standby power systems) for single line of

text. Where two lines of text are required, provide minimum 2" high nameplate. Where three lines of text are required, provide minimum 2.5" high nameplate. Provide white letters on red background for all NEC, or CEC where adopted, Article 517 essential power systems, Article 700 Emergency Systems, Article 701 Legally required standby systems and Article 708 COPS.

- C. Identification nameplates for new switchgear, switchboards, distribution boards, distribution panels, panel boards and motor control centers shall be attached with switchgear manufacturer-provided screws via switchgear manufacturer factory pre-drilled holes. A factory option to rivet identification nameplates to the equipment is only acceptable if screw-fastened nameplates are not an available option from the switchgear manufacturer. Field drilling or other mechanical attachment methods that change/void the NEMA or NTRL rating of the enclosure are strictly forbidden.
- D. Identification nameplates for transformers, transfer switches, disconnect switches, enclosed circuit breakers/switches, inverters, UPSs, PDUs, RDCs, SPDs, lighting control panels, dimming panels, door releasing system panels, terminal cabinets and all circuit breakers/fuses in switchgear, switchboards, distribution boards, distribution panels, UPS output circuit breakers, PDUs, PDU sub-feed circuit breakers, and motor control centers shall be attached to the equipment by self-adhesive backing integral to the nameplates. When equipment is located outdoors, provide nameplates without self-adhesive backing and attach to equipment using weather-rated, UV-resistant epoxy. In all cases, clean surfaces before applying identification nameplates parallel to equipment lines.
- E. Warning Placards, as required by General Single Line Diagram Notes for multiple power sources, or instruction placards, as required for all kirk-key interlock schemes, all UPS bypass procedures or as required elsewhere in the plans/specifications shall be engraved 1/2" high white lettering on a red background using the same material specified for identification nameplates with a self-adhesive backing. Warning/instruction placards shall be attached to the face of the equipment directly related to the placards. Provide a formal placard submittal for review by the Engineer prior to ordering any warning/instruction placards. In all cases, clean surfaces before applying warning/instruction placards parallel to equipment lines.
- F. Receptacles that are part of a UL-listed under floor computer room whip assembly, ceiling and/or cable/ladder tray-mounted receptacles used in lab, manufacturing, commercial kitchen environments or that are serving telecom/data/AV racks and cabinets shall have identification nameplates located on the wiring device plate cover. Nameplates shall be self-adhesive, 3/32" thick Micarta with beveled edges, engraved 1/4" high white lettering on black background with serving power source, circuit identification and NEMA/IEC receptacle type. Use of two (2) separate nameplates per device plate cover is acceptable. Affix nameplates to be visible when plugs are occupying receptacles.
- G. See wiring device section of this specification for wiring device plate cover labeling requirements.
- H. See drawings for panel board schedule directory installation requirements.

- I. See conduit installation section of this specification for conduit labeling requirements.

1.7 FINAL INSPECTION AND ACCEPTANCE

- A. After all requirements of the Specifications and/or the Drawings have been fully completed; representatives of the Owner will inspect the work. Contractor shall provide competent personnel to demonstrate the operation of any item or system to the full satisfaction of each representative.
- B. Final acceptance of the work will be made by the Owner after receipt of approval and recommendation of acceptance from each representative.

1.8 RECORD DRAWINGS

- A. Drawings of Record: The Contractor shall provide and keep up-to-date, a complete record set of drawings. These shall be corrected daily and show every change from the original Drawings. This set of prints shall be kept on the job site and shall be used only as a record set. This shall not be construed as authorization for the Contractor to make changes in the layout without definite instruction in each case. Upon completion of the work, a set of reproducible Contract Drawings shall be obtained from the General Contractor and all changes as noted on the record set of prints shall be incorporated thereon with black ink in a neat, legible, understandable and professional manner. Refer to the Supplementary General Conditions for complete requirements.

1.9 APPROVALS, EQUALS, SUBSTITUTIONS, ALTERNATIVES, NO KNOW EQUAL

- A. Approvals: Where the words (or similar terms) "approved", "approval", "acceptable", and "acceptance" are used, it shall be understood that acceptance by the Owner, Architect and Engineer are required.
- B. Equal: Where the words (or similar terms) "equal", "approved equal", "equal to", "or equal by", "or equal" and "equivalent" are used, it shall be understood that these words are followed by the expression "in the opinion of the Owner, Architect, and Engineer." For the purposes of specifying products, the above words shall indicate the same size, made of the same construction materials, manufactured with equivalent life expectancy, having the same aesthetic appearance/style (includes craftsmanship, physical attributes, color and finish), and the same performance.
- C. Substitution: For the purposes of specifying products, "substitution" shall refer to the submittal of a product not explicitly approved by the construction documents/specifications.
 - 1. Substitutions of specified equipment shall be submitted and received by the Engineer ten (10) days prior to the bid date for review and written approval. Regulatory Agency approval for all substitutions will be the sole responsibility of the Contractor. To receive consideration, requests for substitutions must be accompanied by documentary proof of its equality with the specified material. Documentary proof shall be in letterform and identify the specified values/materials alongside proposed equal values/materials. In addition, catalog

brochures and samples, if requested, must be included in the submittal. ONLY PRE-BID APPROVED PRODUCTS, ISSUED VIA A FORMAL BID ADDENDUM TO ALL BIDDERS, WILL BE ALLOWED ON THE PROJECT. REGARDLESS OF THE APPROVAL ON ANY SUBSTITUTION, ALL BIDS SHALL BE BASED ON THE PRODUCTS EXACTLY AS SPECIFIED. PRICING FOR EACH APPROVED SUBSTITUTION SHALL BE INCLUDED IN THE BID SUBMITTAL AS A SEPARATE LINE ITEM.

2. In the event that written authorization is given for a substitution, after award of contract, the Contractor shall submit to the Engineer quotations from suppliers/distributors of both the specified and proposed equal material for price comparison, as well as a verification of delivery dates that conform to the project schedule.
 3. In the event of cost reduction, the Owner will be credited with 100 percent of the reduction, arranged by Change Order.
 4. The Contractor warrants that substitutions proposed for specified items will fully perform the functions required.
- D. Alternates/Alternatives: For the purposes of specifying products, "alternatives/alternates" may be established to enable the Owner/Architect/Engineer to compare costs where alternative materials or methods might be used. An alternate price shall be submitted in addition to the base bid for consideration. If the alternate is deemed acceptable, written authorization will be issued.
- E. No Known Equal: For the purposes of specifying products, "No Known Equal" shall mean that the Owner/Architect/Engineer is not aware of an equivalent product. The Contractor will need to submit a "Substitution" item, per the requirements listed above, if a different product is proposed to be utilized.

1.10 SHOP DRAWINGS/SUBMITTALS

- A. Shop Drawings/Submittals, unless required otherwise by general project specifications or instructions to bidders, shall be submitted in electronic format (PDF) to include a Letter of Transmittal (PDF), which shall give a list of the drawings submitted with dates and/or system(s) components contained within the submittal. Drawings and material cut sheets shall be complete in every respect and edited/marked to indicate specific items being provided. Printed/Hard copies are not acceptable.
- B. The Shop Drawings/Submittals shall be marked with the name of the project, numbered consecutively, and bear the approval of the Contractor as evidence that the Contractor has checked the Drawings. Any Drawings submitted without this approval will be returned to the Contractor for resubmission.
- C. If the shop drawings show variations from the requirements of the Contract because of standard shop practice or other reasons, the Contractor shall make specific mention of such variations in the Contractor's letter of transmittal. If the substitution is accepted, the Contractor shall be responsible for proper adjustment that may be caused by the substitution. Samples shall be submitted when requested.

- D. Only products listed as "Equal" within the contract documents, along with formally approved "Substitutions" will be reviewed. Products not conforming to these items will not be reviewed and will be returned to the Contractor for re-submittal.
 - E. Review comments used in response to shop drawings/submittals are:
 - 1. "No Exception Taken" - Product approved as submitted.
 - 2. "Furnish as Corrected" - Re-submittal not required, although the Contractor shall provide the submitted product with corrections as noted.
 - 3. "Revise and Resubmit" - Re-submittal required with corrections as noted.
 - 4. "Rejected" - Re-submittal required based upon the originally specified product.
 - F. Shop drawings shall be submitted on the following but not limited to:
 - 1. Lighting Fixtures, Lamps, and Ballasts.
 - 2. Switchgear, Switchboards, Distribution Boards, Motor Control Centers, Panel boards, and Bus Ducts; complete with overcurrent device information.
 - 3. Transformers.
 - 4. Fire Alarm System/Central Monitoring System.
 - 5. Wiring Devices.
 - 6. Lighting Control System/Dimming System Products.
 - 7. Pullboxes and Underground Vaults.
 - 8. Terminal Cabinets
 - 9. Lighting Inverters, UPSs, RDCs, PDUs, SPD Systems.
 - 10. Cable Tray, Flexible Cable Tray and Cable Runway.
 - 11. Power Poles and Floor Boxes.
 - 12. Arc Flash, Short-Circuit and Coordination studies.
 - 13. All other products called out on drawings that call for shop drawing submittal.
- 1.11 MAINTENANCE, SERVICING, INSTRUCTION MANUALS AND WIRING DIAGRAMS
- A. Prior to final acceptance of the job, the Electrical Contractor shall furnish to the Owner at least four (4) copies of operating, maintenance, and servicing instructions, as well as four (4) complete wiring diagrams for the following, but not limited too, items or equipment:
 - 1. Lighting Control System/Dimming Systems.

2. Fire Alarm System.
 3. Transformers.
 4. Switchgear, Switchboards, Distribution Boards, Motor Control Centers, Panel boards, and Bus Ducts; complete with overcurrent device information
 5. Lighting Inverters, UPS's, PDUs, , SPD Systems
- B. All wiring diagrams shall specifically cover the system supplied. Typical drawings will not be accepted. Four (4) copies shall be presented to the Owner.

1.12 INTERRUPTION OF SERVICE/SERVICE SHUTDOWN

- A. Any interruption of electrical services, electrical circuits, electrical feeders, signal systems, communication systems, fire alarm systems, etc. required to perform work, shall meet the specific prior-approval requirements of the Owner. Such work shall be scheduled with the Owner to be performed at the Owner's convenience.
- B. Interruptions/outages of any of the Owner's systems and services mentioned above shall be scheduled to occur during other than the Owner's normal business hours. Any overtime costs shall be borne by the Contractor.
- C. See drawings for any additional requirements regarding outages, interruption and any temporary services required.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials and Equipment: All electrical materials and equipment, including custom-made equipment, shall be new and shall be listed by Underwriter's Laboratories (UL) and bear their label or be listed and certified by a Nationally Recognized Testing Lab (NRTL) that is also recognized by the local Authority-Having-Jurisdiction (AHJ)
- B. Switchgear/Switchboards/Distribution Boards/Motor Control Centers:
 1. See general single line notes on single line drawing for more information.
- C. Panel boards – Branch Circuit:
 1. See drawings for panel board schedules and specifications.
- D. Transformers:
 1. See drawings for transformer schedules and specifications.
- E. Lighting Fixtures:

1. See drawings for lighting fixture and lamp schedules and additional specifications. Furnish, install and connect a lighting fixture at each outlet where a lighting fixture type symbol (designated on plans) is shown as being installed. Each fixture shall be complete with all required accessories including sockets, glassware, boxes, spacers, mounting devices, fire rating enclosure and lamps.
2. Ballasts: See lighting fixture schedule notes. All noisy ballasts shall be replaced at no cost to the Owner.
3. Lamps: See lamp/fixture schedule and lamp/lighting fixture schedule notes.

F. Wiring Devices:

1. Provide wiring devices indicated per plan. Devices shall be specification grade. Acceptable manufacturers are Leviton, Pass and Seymour and Hubbell. Provide all similar devices of same manufacturer, unless indicated otherwise. All device colors shall be from the full range of manufacturer standard color options as selected by the Architect. This selection will be made during the shop drawing review process

a. Wiring Devices (Decora)

- 1) Convenience Receptacle #16252- ???
- 2) Dedicated Receptacle #16352-???
- 3) Convenience I.G. Receptacle #16262-IG-???
- 4) Dedicated I.G. Receptacle #16362-IG-???
- 5) Convenience G.F.C.I. Receptacle #GFT1-???
- 6) Dedicated G.F.C.I. Receptacle #GFNT2-???
- 7) Convenience Hospital Grade Receptacle #16252-HG?-???
- 8) Dedicated Hospital Grade Receptacle #16352-HG?-???
- 9) Convenience G.F.C.I. Hospital Grade #GFNT1-HG?
- 10) Dedicated G.F.C.I. Hospital Grade #GFNT2-HG?
- 11) Tamper Resistant Convenience Receptacle #TDR15-???
- 12) Tamper Resistant Dedicated Receptacle #TDR20-???
- 13) Tamper Resistant GFCI Receptacle #GFTR2-???
- 14) Tamper Resistant. Convenience. G.F.C.I. Hospital Grade Receptacle
- 15) #GFTR1-HG?

- 16) Tamper Resistant. Dedicated. G.F.C.I. Hospital Grade Receptacle
 - 17) #GFTR2-HG?
 - 18) Weather/Tamper Resistant GFCI Receptacle #GFWT2-???
 - 19) Convenience Simplex Receptacle #16251-???
 - 20) Dedicated Simplex Receptacle #16351-???
 - 21) Recessed Clock Receptacle #5361-CH-???(Non-Decora)
 - 22) Single Pole Switch #5621-2-???
 - 23) Double Pole Switch #5622-2-???
 - 24) Three Way Switch #5623-2-???
 - 25) Four Way Switch #5624-2-???
 - 26) Pilot Light Switch "On" #5628-2-???
 - 27) Pilot Light Switch "Off" #5631-2-???
 - 28) Projection Screen Switch #5657-2-???
 - 29) Low Voltage Momentary Switch#5657-2-???
 - 30) Keyed Switch #1221-2L-???(Non-Decora)
 - 31) Door Jam Switch #1865-???
- b. Use of dedicated receptacles is required where plans depict a branch circuit supplying only a single simplex or duplex receptacle. Use of controlled receptacles is required where depicted on plans - see controlled receptacle specifications for additional information.
2. I.G. (isolated ground) receptacle bodies shall be of a basic color specified above with an orange triangle to symbolize isolated ground.
 3. H.G. (hospital grade) receptacle bodies shall be of a basic color specified above with a green circle to symbolize hospital grade.
 4. When shown circuited with an I.G. conductor, receptacles shall be of an I.G. type. As an example, a NEMA L6-30R denoted on the plans and shown circuited with an I.G. conductor shall be an I.G. version of that receptacle.
 5. Wiring devices located in wood finished areas shall generally be black unless otherwise indicated by the Architect.
 6. Wiring devices located in mirrors shall generally be white with stainless steel cover plates unless otherwise indicated by the Architect.

7. In addition to other device requirements listed elsewhere in this specification, 125V (Volt), 15A (Amp) and 20A Tamper-Resistant wiring devices shall be provided as follows:
 - a. In dwelling units per NEC, or CEC where adopted, Article 210.52.
 - b. In pediatric care areas per NEC, or CEC where adopted, Article 517.18(C).
 - c. In child care or day care facilities.
 - d. In wet and/or exterior locations.
8. Wiring device cover plates located on recessed boxes shall be commercial grade nylon. Plate color shall match wiring device color UON on plans. Cover plates utilized on surface mounted boxes shall be metal. Plastic cover plates are unacceptable.
9. Except as otherwise noted, all wiring device plates on the project shall be labeled with panel and circuit number(s) utilizing a Brother P-Touch labeling system with 1/2" tape (yellow on black) or equal by Herman-Tellerman or Panduit. Locate label on the concealed side of the wiring device plate. Handwritten labels are unacceptable.
10. The Contractor shall provide duplex receptacle outlets in the appropriate configurations necessary to comply with applicable energy code requirements for controlled receptacles and as shown on plans. All wiring devices indicated to be controlled receptacles shall be NEMA-approved, electrical code-compliant with factory markings on the face of the receptacle(s) with the word "Controlled" or utilize further markings and symbols to indicate which receptacles on each outlet is/are controlled. Stickers, field-applied markings or other non-permanent markings are not acceptable. Where a GFCI receptacle outlet is required to be controlled, provide an adjacent controlled duplex receptacle outlet connected on the load side of the GFCI outlet. Generally, one receptacle in a duplex receptacle outlet is required to be controlled. It may be the lower receptacle or upper receptacle based on manufacturer offering. However, the controlled receptacle location within a controlled receptacle outlet shall remain consistent throughout the project. Where an existing duplex receptacle outlet is required to be controlled, provide a new wiring device with the appropriate control configuration necessary to comply with plans. All controlled receptacles shall be connected to a branch circuit controlled by an occupancy sensor-based or relay panel lighting control system. Acceptable manufacturers are Leviton, Pass and Seymour and Hubbell.
11. The following wiring device plates shall have custom engraving:
 - a. Key operated switches, switches with pilot lights, and switches for the control of motors, heaters and ventilators. Engraving shall be black and occur on the exposed side of the plate indicating the motor, heater, or ventilator controlled.

- b. Receptacles on optional standby generator and/or UPS power shall have custom engraved plates with the words "Generator" or "UPS" in black letters. In addition, where located in telecommunications closets, IDFs, server rooms, data centers, labs (wet, dry or electronic) indicate panel board and circuit number.
 - c. All stainless steel and nylon device plates shall be engraved using a rotary engraving process except for black lettering on stainless steel device plates which may be accomplished via laser etching process. All lettering shall be 3/16" high. Provide a dimensioned submittal drawing detailing a typical device faceplate with engraving.
- G. Weatherproof Outlet Covers/Assemblies: All Receptacles identified as weatherproof on the drawings shall be weather-resistant, tamper-resistant, GFCI type and equipped as follows:
 - 1. Type WP-A: Recessed wall box with a hinged, lockable, cast aluminum, self-closing, gasket-equipped door that is wet location-listed rain tight while "in use". Unit shall comply with NEC, or CEC where adopted, Article 406.9(A) and (B). UON on drawings, provide a minimum of 2 separate compartments suitable for installation of power receptacles, AV or communications outlets. Additionally, unless otherwise noted on drawings, provide the following:
 - a. A 20A weather-resistant, tamper-resistant, GFCI duplex receptacle in the first compartment. Provide branch circuiting per plans.
 - b. A blank metal plate suitable for field installation of power, AV or communications devices in the second compartment.
 - c. Where indicated on plans as requiring data, AV, or other low voltage service outlet, provide minimum 3/4" C.O. with pull string routed from the second compartment to nearest low voltage pull box. Where shown mounted in a building wall, any blank/unused compartment shall be equipped min. 3/4" C.O. with pull string routed to the nearest accessible ceiling space.
 - d. See wiring device section of this specification for additional wiring device plate cover labeling requirements.
 - e. 1 key minimum per device (minimum of 2 per project) to the Owner's project manager upon completion of project.
 - f. Custom color powder coat finish as selected by Architect - Include all costs in base bid for same.
 - g. In locations with sufficient wall depth, provide 6" wide x 6" tall x 5-1/2" deep recessed wall box (C.W. Cole #TL310-WCS-K1-CUSTOM COLOR).
 - h. In locations utilizing shallow stud walls construction or other walls of insufficient depth, provide 10-3/4" wide x 7-3/8" tall x 3-7/8" deep recessed wall box (C.W. Cole #TL310-WCS-SH-K1 -CUSTOM COLOR).

- i. See drawings for additional details.
2. Type/Subscript WP-B: Wet location-listed raintight while "in use" cast copper-free aluminum lockable cover with baked aluminum lacquer finish and one gang, weather-resistant, tamper-resistant GFCI receptacle. Hubbell WP26E series. Polycarbonate covers are unacceptable. Unit shall comply with NEC, or CEC where adopted, Article 406.9(A) and (B). Contractor shall powder coat cover assembly to a custom color where receptacle locations are deemed by the Architect to be in aesthetically sensitive or public spaces. Custom color as selected by Architect.
3. Type WP-C: (C.W. Cole #TL310-WCS-PED-ADA-K1-CUSTOM COLOR or #TL310-WCS-PED-K1-CUSTOM COLOR) pedestal device box with a hinged, lockable, cast aluminum, self-closing, gasket-equipped door that is wet location-listed raintight while "in use". Unit shall comply with NEC, or CEC where adopted, Article 406.8(A) and (B). UON on drawings, provide a minimum of 2 separate compartments suitable for installation power receptacles, AV or communications outlets. Additionally, unless otherwise noted on drawings, provide the following:
- a. A 20A weather-resistant, tamper-resistant, GFCI duplex receptacle in the first compartment. Provide branch circuiting per plans.
 - b. A blank metal plate suitable for field installation of power, AV or communications devices in the second compartment.
 - c. Where indicated on plans as requiring data, AV, or other low voltage service outlet, provide minimum 3/4" C.O. with pull string routed from the second compartment to nearest low voltage pull box.
 - d. See wiring device section of this specification for additional wiring device plate cover labeling requirements.
 - e. 1 key minimum per device (minimum of 2 per project) to the Owner's project manager upon completion of project.
 - f. Include all costs in base bid for ADA version (22.5" tall) of pedestal box. Prior to ordering material, contractor shall coordinate with Architect and/or AHJ to determine which pedestal box locations do not require ADA compliance and may be changed to the standard (11.5" tall) version of the pedestal box.
 - g. Custom color powder coat finish as selected by Architect. Include all costs in base bid for same.
 - h. See drawings for additional details.
4. Type/Subscript WP-D: Damp location-listed (not-Raintite-in-use) cast copper-free, pad lockable, die-cast aluminum cover with baked aluminum lacquer finish and one gang GFCI receptacle. Hubbell/Rayco 502?/503? Series. Polycarbonate covers are unacceptable. Unit shall comply with NEC, or CEC

where adopted, article 406.9(A) and (B). Custom color powder coat finish as selected by Architect. Include all costs in base bid for same.

- H. Motor Controllers/Starters: See drawings for motorized equipment schedules and specifications.
- I. Circuit Breakers:
 - 1. Service entrance circuit breakers smaller than 400A (Amp) frame shall be thermal-magnetic trip with inverse time current characteristics unless otherwise indicated below. Service entrance main circuit breakers and main circuit breakers, 400A frame and larger shall be 100% rated, solid-state type as outlined in this specification. All other service entrance circuit breakers, 400A frame and larger, shall be 100% rated, solid-state type as outlined in this specification.
 - 2. All non-service entrance circuit breakers 225A and larger shall be thermal magnetic type and have continuously adjustable instantaneous pick-ups of approximately 5 to 10 times trip rating. Breakers shall have either tamper-resistant rating dials or easily changed trip rating plugs with trip ratings as indicated on the Drawings. Rating plugs shall be interlocked so they are not interchangeable between frames. Additionally, all non-service entrance circuit breakers, 600A frame and larger, located in 480V, 3-phase, 3-wire or 277/480V, 3-phase, 4-wire switchgear, distribution boards, panel boards or busway plugs shall be solid state, 100% rated. Breaker shall have built-in test points for testing long delay, short delay and instantaneous, and ground fault (where shown) functions of the breaker by means of a 120V operated test kit. Contractor shall utilize a test kit capable of testing all breakers 400A and above - at the Engineer's request.
 - 3. All non-service entrance circuit breakers less than 225A shall be molded plastic case, air circuit breakers conforming to UL 489. Provide breakers with thermal magnetic trip units, and a common trip bar for two- or three-pole breakers, connected internally to each pole so tripping of one pole will automatically trip all poles of each breaker. Provide breakers of trip-free and trip-indicating bolt-on type, with quick-make, quick-break contacts. Provide single two- or three-pole breaker interchangeability. Provide padlocking device for circuit breakers as shown on the Drawings.
 - 4. Where a Current Limiting Circuit Breaker (CLCB) is indicated on drawings or as required elsewhere in this specification, provide a UL listed current limiting thermal magnetic circuit breaker(s) UON. An independently operating limiter section within a molded case is not allowed. Coordinate CLCB ratings as required to protect electrical system components on the load side of the CLCB to include, but not limited to, protecting automatic transfer switches, panel boards and lighting control panels.
 - 5. Where a solid-state circuit breaker is indicated on drawings or as required elsewhere in this specification, provide a solid-state circuit breaker with minimum five function complete with built-in current transformers. The five functions shall be independently adjustable and consist of Overload/Long Time Amp Rating,

Long Time Delay, Short Time Delay, Short Circuit/Instantaneous Pickup, but may also include Shunt Trip and/or Ground Fault if so indicated on the Drawings. Rating plugs shall be interlocked so they are not interchangeable between frames. Breaker shall have built-in test points for testing long delay and instantaneous, and ground fault (where shown) functions of the breaker by means of a 120V operated test kit. Contractor shall utilize a test kit capable of testing all breakers 400A and above, at the Engineer's request.

6. Ground Fault Interrupting Breakers: Provide with molded plastic case, air circuit breakers, similar to above with ground fault circuit interrupt capability, conforming to UL Class A, Group 1.
7. Arc Fault Interrupting Breakers: Provide with molded plastic case, air circuit breakers, similar to above with arc fault circuit interrupt capability, conforming to UL 1699. Provide on all dwelling-unit circuits supplying bedrooms, sleeping quarters etc. as required to comply with NEC, or CEC where adopted, Article 210.12.
8. Tandem or half-sized circuit breakers are not permitted.
9. Series-Rated Breakers: UL listed series-rated combinations of breakers can be used to obtain panelboard-interrupting ratings shown on Drawings. If series-rated breakers are used, switchboards, distribution boards, and panel boards shall be appropriately labeled to indicate the use of series-rated breakers. Shop drawing submittal shall include chart of UL listed devices, which coordinate to provide series rating.
10. Circuit breakers shall be standard interrupting construction. Panelboard shall accept standard circuit breakers up to 100A.
11. Circuit breaker handle accessories shall provide provisions for locking handle in the on or off position.
12. Shunt-trip equipped circuit breakers shall be provided on all elevator feeders.
13. Temperature compensating circuit breaker(s) shall be provided when located in outdoor enclosure(s) or when located in an enclosure subject to high ambient heat due to due nearby industrial processes, etc.
14. Provide 75 degree Celsius-rated conductor lugs/lug kits as required on all circuit breakers to accept conductor quantities and sizes shown on drawings.
15. All circuit breaker terminations shall be suitable for use with 75 degree Celsius ampacity conductors. Listed, dual-rated pin terminals, straight or offset, are acceptable for use to in accommodating oversized or parallel conductor installations.
16. Circuit breakers serving Fire Alarm or Central Monitoring panels and power supplies shall be red in color and lockable in the "ON" position.

J. Disconnect Switches:

1. Non-fusible or fusible, heavy-duty, externally-operated horsepower-rated, 600V A.C: Provide NEMA 3R, lockable enclosures for all switches located on rooftops, in wet or damp areas and in any area exposed to the elements.
2. Fusible switches shall be Class "R" when 600A or less or Class "L" when greater than 600A.
3. Amperage, Horsepower, Voltage and number of poles per drawings: All shall be clearly marked on the switch nameplate.
4. Provide the Owner's project manager with one (1) spare set of fuses and two (2) sets of fuse clips/fuses for every set of fuses on the project.

K. Fuses:

1. Provide fuses at all locations shown on the Drawings and as required for supplemental protection:
 - a. Fuses shall be manufactured by Bussman, Shawmut, or equal.
 - b. All fuses shall be the product of a single manufacturer.
2. Main and Feeder Protection:
 - a. Protective devices rated greater than 600A: Provide Bussman Hi-Cap fuses, Class L, current limiting, having an interrupting rating of 200,000A RMS.
 - b. Protective devices rated 600A or less: Provide Bussman Class R fuses, Class RK series current limiting fuses, having an interrupting rating of 200,000A RMS.
3. Motor Protection:
 - a. Where rating of protective device is greater than 600A, provide Bussman Hi-Cap fuses, Class L, current limiting, having an interrupting rating of 200,000A RMS.
 - b. Where rating of protective device is 600A or less, provide Bussman Class RK series current limiting fuses, having an interrupting rating of 200,000A RMS.
 - c. Where fuses feeding motors are indicated, but not sized, it shall be the responsibility of the Contractor to coordinate the fuse size with the motor to provide proper motor running protection.
 - d. When rejection type fuses are specified (Class RK series) the fuse holder of all switches (specified in other Sections) shall be suitable for the fuses provided.

L. Cable Tray, Flexible Cable Tray and/or Cable Runway:

1. See drawings for Cable Tray, Flexible Cable Tray and/or Cable Runway specifications.

M. Uninterruptible Power Systems (UPS):

1. See drawings for UPS schedules and specifications.

N. Power Distribution Units (PDU):

1. See drawings for PDU schedules and specifications.

O. Lighting Control/Dimming Systems:

1. See drawings for Lighting Control and/or Dimming Systems schedules and specifications.
2. Wall box dimmers shall be rocker-type as manufactured by Lutron (no known equal except as noted below). Dimmers and dimmer faceplates shall match the color of adjacent switches and faceplates. Dimmers and dimmer faceplates in wood finished areas shall generally be black unless otherwise indicated by the Architect. The Contractor shall obtain written approval of the Architect regarding final dimmer and dimmer faceplate color selection prior to ordering material. Multiple dimmers/switches shall be ganged together with a common cover plate. Provide dimmers as follows:
 - a. Incandescent: Lutron DIVA DV-10P or DV-103P (3-way) (1000 Watt max.).
 - b. Electronic Low Voltage: Lutron DIVA DVELV-300P or DVELV-303P- (3-way) (300 Watt).
 - c. Magnetic Low Voltage: Lutron DIVA DVLV-10P or DVLV103p (3-way) (800 Watt max.).
 - d. Fluorescent (3-Wire): Lutron DIVA DVF-103P (single/3way, 8A @ 120V) or DVF-103P-277 (single/3way, 6A @ 277V).
 - e. Fluorescent (0-10V): Lutron DIVA DVTV with PP-???H Power Pack.
 - f. Fluorescent (Lutron Tu-Wire): Lutron DIVA DVFTU-5A3P with Lutron H.P. module where required.
 - g. LED (0 - 10V): Lutron DIVA DVTV with PP-???H Power Pack.
 - h. Screw Base CFL/LED: Lutron DIVA DVCL-153P.
 - i. Fan Control: Lutron DIVA DVFSQ-F (1.5A @ 120V max, 3 speed, single pole, 3-way).
3. Contractor shall verify if dimmer(s) requires derating when ganged. Contractor shall provide, and provide connections to, additional Lutron Power Modules, Lutron Power Packs, and / or Lutron Interface Modules where required to accommodate loads higher than dimmers standard or derated load-carrying

capacity. Note - contractor may to provide a Lutron recommended dimmer type (typically a #DVF-103P unit) to control the necessary power modules or interface devices.

P. Fire Alarm System/Central Monitoring System:

1. See drawings for Fire Alarm System or Central Monitoring System specifications.

Q. Surge Protective Device (SPD):

1. See drawings for SPD specifications.

R. Conduit:

1. Galvanized Rigid Conduit (GRC) shall be full weight threaded type steel. Steel conduit shall be protected by overall zinc coating to inside and outside surfaces, applied by the hot dip, metalizing, or sherardizing process.
2. Intermediate Metal Conduit (IMC), shall be hot-dipped galvanized in accordance with UL 1242, and meet Federal Specification WWC-581 (latest revision).
3. Electrical Metallic Tubing (EMT) shall be zinc-coated steel with baked enamel or plastic finish on inside surfaces. EMT shall be dipped in a chromic acid bath to chemically form a corrosion-resistant protective coating of zinc chromate over galvanized surface.
4. Flexible metal conduit shall be constructed of aluminum or hot-dipped galvanized steel strips wound spirally with interlocking edges to provide greatest flexibility with maximum strength. Interior surfaces shall be smooth and offer minimum drag to pulling in conductors. Use only as directed in writing by the Engineer with the exception of 400 Hz feeders and 400 Hz branch circuits which shall be run in flexible aluminum conduit.
5. Liquid-tight conduit (Seal-Tite) shall be galvanized steel flexible conduit as above except with moisture and oil-proof jacket, pre-cut lengths and factory-installed fittings. For outdoor installations and motor connections only unless otherwise noted on drawings.
6. Factory assembled, or off-site assembled wiring systems (such as Metal Clad (MC) Cable, Type AC Cable, Type NM Cable, Type BX Cable, etc.) shall not be used unless otherwise indicated in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing.
7. When approved for use in the Allowed Specification Deviations Section, generally located on the symbols list drawing, MC cables shall be allowed for lighting branch circuits (homeruns shall be EMT), receptacle branch circuits (homeruns shall be EMT) and poke-thru fed systems furniture homeruns. MC shall not be used where exposed, except for a maximum 6' length for final connections to light fixtures, or terminate in electrical panelboards or distribution boards. Equipment ground conductor shall be green. Isolated ground conductor

shall be green with yellow stripe. Provide 600V rated aluminum or lightweight steel interlocking armor Metal Clad (MC) cable with copper conductors, THHN (90 degrees C) insulation, and integral equipment grounding conductor and isolated grounding conductor as required. Type AC cable listed for use in patient care areas for non-essential electrical system branch circuits per NEC or CEC where adopted, Article 517.13 shall be required in such areas in lieu of MC cable. Type AC and MC cable shall not be used for essential electrical system branch circuits. MC cable shall be manufactured to Underwriter Laboratory Standard 1569. See PART 3 - EXECUTION section of this specification for additional installation requirements.

8. Nonmetallic Flexible Tubing (ENT) shall not be used unless otherwise indicated in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing. Use of ENT, if allowed, is strictly limited to use in CMU walls and parking structures decks or as directed in writing by the Engineer. See PART 3 - EXECUTION section in this specification for additional installation requirements.
9. Non-Metallic Conduit:
 - a. Polyvinyl chloride (PVC) rigid conduit, Schedule 40, Type II for underground installation only with solvent welded joints, conforming to Underwriters Laboratories, Inc. (UL) requirements, listed for exposed and direct burial application.
 - b. Conduit and fittings shall be produced by the same manufacturer.
10. Fire-rated MC Cable:
 - a. 2-hour fire-rated, polymer insulated 600V MC cable listed and conforming to Underwriters Laboratories, Inc. (UL) 2196 and UL 1569 requirements for installation as an Electrical Circuit Protective System for use in complying with NEC, or CEC where adopted, Articles 695 and 700. Where adopted, cable sheath shall be suitable for use as a NEC or CEC equipment grounding conductor, and shall be listed for use in wet locations to 90 degrees C (Raychem or equal).
 - b. Cable connectors shall be brass MC connectors.

S. Fittings:

1. Condulet type fittings shall be smooth inside and out, taper threaded with integral insulating bushing and of the shapes, sizes and types required to facilitate installation or removal of wires and cables from the conduit and tubing system. These fittings shall be of metal, smooth inside and out, thoroughly galvanized, and sherardized cadmium plated.
2. Metallic condulet covers shall have the same finish as the fitting and shall be provided for the opening of each fitting where conductors do not pass through the cover.

3. Connector, coupling, locknut, bushings and caps used with rigid conduit shall be steel, threaded and thoroughly galvanized. Bushings shall be insulated.
4. UON all EMT fittings, connectors and couplings installed in concealed locations, areas not considered to be wet or damp locations by the AHJ, or areas not subject to physical damage, shall be steel, zinc or cadmium plated, threadless, compression, steel locking ring type with insulated throat. Where suitable for use, steel set screw fittings are allowed for trades sizes of 2" and smaller. Insulated throat is not required for fittings, connectors and couplings 1" and smaller.
5. All interior and exterior EMT fittings, connectors and couplings, 2" and smaller, installed in exposed or concealed locations that are considered by the AHJ to be wet or damp locations, shall be Raintite-listed, steel, zinc or cadmium plated, threadless, compression, steel locking ring type with insulated throat. If Raintite-listed, EMT fittings, connectors and couplings are unavailable for a given trade size or if conduit is installed in an area subject to damage – provide rigid metallic or intermediate metallic conduits, fittings, connectors and couplings as required.
6. Flexible steel conduit connectors shall be a malleable iron clamp or squeeze type or steel twist-in type with insulated throat. The finish shall be zinc or cadmium plating.
7. Conduit unions shall be "Erickson" couplings, or approved equal. The use of running threads will not be permitted.

T. 600 Volt Conductors - Wire and Cable:

1. All conductors shall be copper. Provide stranded conductor for #10 AWG and larger or when making flexible connections to vibrating machinery. Use compression "fork" type connectors or transition to solid conductors when connecting to switches, receptacles, etc.
2. Type THHN/THWN-2 thermoplastic, 600 volt, UL approved, dry and wet locations rated at 90 degrees Celsius, for conductors of all sizes from #12 AWG up to and including 1000 kcmil. RHH/RHW insulation is allowed only to provide an Electrical Circuit Protective System to comply with NEC, or CEC where adopted, Articles 695 and 700.
3. Wire and cable shall be new, manufactured not more than six (6) months prior to installation, shall have size, type of insulation, voltage rating and manufacturer's name permanently marked on outer covering at regular intervals.
4. Wire and cable shall be factory color-coded by integral pigmentation with a separate color for each phase and neutral. Each system shall be color-coded and it shall be maintained throughout.
5. Systems Conductor Color Coding:
 - a. Power 208/120V, 3PH, 4W:

- 1) Phase A = Black
 - 2) Phase B = Red
 - 3) Phase C = Blue
 - 4) Neutral = White or White with Phase Color Tracer
 - 5) Switch legs = Purple (Switch legs shall also be identified separately by numerical tags).
 - 6) Travelers = Purple with Black stripe or Pink.
- b. Power 480/277V, 3PH, 4W:
- 1) Phase A = Orange
 - 2) Phase C = Yellow
 - 3) Neutral = Grey or Grey with Phase Color Tracer
 - 4) Switch legs = Purple (Switch legs shall also be identified separately by numerical tags).
 - 5) Travelers = Purple with black stripe or Pink..
- c. Ground Conductors: Green
- d. Isolated Ground Conductors: Green with continuous yellow stripe.
- e. Fire Alarm System: As recommended by the manufacturer.
6. All color-coding for #12 through #6 AWG conductor shall be as identified above. Conductors #4 AWG and larger shall be identified with utilizing phase tape at each termination.
7. No conductors carrying 120V or more shall be smaller than #12 AWG.
8. Aluminum conductors shall not be used.
9. Wire-pulling compounds used as lubricants in installing conductors in raceways shall only be "Polywater J". No oil, grease, graphite, or similar substances may be used. Pulling of #1/0 or larger conductors shall be done with an approved cable pull machine. Other methods; e.g. using vehicles and block and tackle to install conductors are not acceptable.
- U. Junction and Pullboxes:
1. For interior dry locations, boxes shall be NEMA 1 galvanized one-piece drawn steel, knockout type, with removable, machine screw secured covers.

2. For outside, damp or surface locations, boxes shall be NEMA 3R heavy cast aluminum or cast iron with removable, gasketed, non-ferrous machine screw secured covers.
3. For in-grade applications, junction and pull boxes shall be pre-cast concrete or molded fiberglass manufactured by Christy, Brooks-Jensen, or Utility Vault Co. Fiberglass boxes shall:
 - a. Be used only in landscape planter areas that are not subject to damage from lawnmowers, tractors and other machinery.
 - b. Not be used in lawn or turf areas.
 - c. Not exceed 11" W x 17" L in size unless required to be larger to meet code requirements.
4. All boxes shall be sized for the number and sizes of conductors and conduits entering the box and equipped with plaster rings where required.
5. All boxes located in traffic areas shall be traffic rated.

V. Outlet Boxes:

1. For fixtures, boxes shall be galvanized, one-piece drawn steel, knockout type equipped with 3/8" fixture studs and plaster rings where required.
2. For convenience outlets, wall switches, or other devices, outlet boxes shall be galvanized one-piece drawn steel, knockout type 4" x 4"x 2-1/8" minimum size with plaster rings as required.
3. For locations where standard boxes are not suitable due to number and size of conduit to be terminated, special boxes shall be designed to fit space or meet other requirements, and submitted for approval.
4. For exposure to weather, damp locations, or surface mounting, outlet boxes shall be heavy cast aluminum or cast iron with threaded hubs; covers shall be watertight with gaskets and non-ferrous screws.
5. Outlet boxes used for support of ceiling fans shall be galvanized, one-piece drawn steel, knockout type equipped with bracing bars and plaster rings where required and listed for ceiling fan support use. Such boxes shall be labeled and capable of supporting ceiling fan weights up to 70 pounds.
6. See drawings for floor box installation notes and specifications.

- W. Plywood Backboards:** Where indicated for telephone or communications system terminals or other equipment assemblies, provide backboards of size indicated. Use 3/4" thick x 8' all (length per plans), Douglas Fir, void-free, kiln-dried, fire-rated plywood finished on one side and prime coat painted on all surfaces with finish coat of enamel paint, color by Architect. Leave one (1) fire-rating stamp/sheet exposed for inspection.

X. Terminal Cabinets:

1. Terminal cabinets shall be fabricated of hot dipped galvanized code gauge sheet metal for flush or surface mounting, complete with barriered sections, a door for each vertically barriered section and sizes as indicated on plan. Doors shall be hinged and lockable. Locks shall be keyed to match the branch circuit panelboards. Terminal cabinet trims shall match the branch circuit panels.
2. Provide each terminal cabinet with a full size mounting backplate.
3. Terminal cabinets shall be installed complete with full-length skirts of the same construction and finish as the terminal cabinet.
4. Where mounted outdoors, terminal cabinets shall be NEMA 3R, weatherproof complete with gaskets and required sealant to prevent moisture from entering the terminal cabinet.
5. All terminal cabinets and terminal cabinet barriered sections shall be labeled by the cabinet or cabinet section use (i.e. CATV, Security, etc.). Labels shall be Micarta type as specified elsewhere in these specifications. Unless otherwise noted, all termination blocks and cables shall be labeled per ANSI/EIA 606 standard.

Y. Painting: Terminal cabinets, panels, junction boxes, pull boxes, etc., and conduit installed in public view shall be painted with colors selected by the Architect to match the subject surfaces. Refer to painting section of the specifications for additional requirements.

Z. Seismic Design, Certification and Anchoring of Electrical Equipment:

1. Contractor shall include all costs in the base bid for labor, materials, all special inspections and structural engineering design necessary to meet the Seismic Design Requirements for Non-structural Components (Chapter 13, ACE SEI 7-05 Minimum Design loads for Buildings and Other Structures) as required by IBC, or CBC where adopted, Section 1708 and as related to the installation all electrical equipment furnished under this contract. See Specific Project Site Seismic Criteria on architectural and/or structural plans which include Building Occupancy Category, Seismic Design Category, Design Spectral Response Acceleration (SDS), Height factor ratio (z/h) and Site Class. Non-structural Component Importance Factor (IP) for a particular component shall be determined based on the following criteria:
 - a. IP = 1.0: Non-life safety, Non-structural Components in an Occupancy Category IV Facility not required for continued operations of the facility or in any other Occupancy Category Facility where component failure will not impair continued operation of the facility.
 - b. IP=1.5: Designated Seismic Systems are those non-structural components in any Occupancy Category IV facility (except as noted above) or that are a part of any code-defined Critical, Life Safety, Emergency and Legally Required Standby Electrical System. Additionally, those non-structural

components containing hazardous materials shall be classified as Designated Seismic Systems. While Designated Seismic Systems are generally identified on the plans, they may include items such as generators, automatic transfer switches, UPS units and all associated electrical distribution equipment and components necessary for the designated seismic system to form a complete and operable system. The Contractor shall ultimately be responsible for identifying Designated Seismic Systems. For any electrical component either identified on the plans or determined by the contractor to be a Designated Seismic System, all line and load side electrical distribution systems supporting that Designated Seismic System (including, but not limited to, feeders, panel boards switchboards, transformers, all related component supports and attachments etc.) shall be considered a part of the designated seismic system for the purposes of code-compliance and seismic certification.

- c. z/h - Height factor ratio: See plans for respective equipment locations.
2. Provide a delegated-design submittal for each of the following seismic-restraint systems to be used as required:
- a. Restraint Channel Bracings consisting of MFMA-4, shop-or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.
 - b. Restraint Cables consisting of ASTM A 603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service, with a minimum of two clamping bolts for cable engagement.
 - c. Seismic-Restraint Accessories consisting of hanger rod/hanger rod stiffener assemblies, multifunctional steel connectors for attaching hangers to rigid channel bracings and/or restraint cables, bushings for floor and wall-mounted equipment anchor bolts and resilient isolation washers and bushings.
 - d. Mechanical Anchor Bolts consisting of drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.
 - e. Adhesive Anchor Bolts consisting of drilled-in and capsule anchor system containing resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide specific LEED-compatible environmentally-friendly resins and adhesives on all LEED projects. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

3. Submittal shall include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the contractor's structural engineer responsible for their preparation. Calculations shall include, but not be limited to, static and dynamic loading caused by equipment weight, operation, and seismic and, if applicable, wind forces required to select seismic and, if applicable, wind restraints and for designing vibration isolation bases. Provide seismic and wind-restraint detailing to support system selection, arrangement of restraints, attachment locations, methods, and spacings with all components identified to include their strengths, directions and values of forces transmitted to the structure during seismic events and association with vibration isolation devices. Sizes of components shall be selected so strength will be adequate to carry present static and seismic loads to accommodate 25% spare future capacity within specified loading limits.
4. Any pre-approval and evaluation documentation shall have a California Office of Statewide Health Planning and Development (OSHPD) Special Seismic Certification Preapproval (OSP) demonstrating horizontal and vertical load testing and analysis showing maximum seismic-restraint ratings, by ICC-ES or another agency acceptable to authorities having jurisdiction. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
5. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified elsewhere in the project specifications.
6. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment. Flexible connection limitations of the NEC, or CEC where adopted, shall apply.
7. Install seismic-restraint devices using methods approved by OSHPD or an agency acceptable to authorities having jurisdiction providing required submittals for component.
8. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by OSHPD or an agency acceptable to authorities having jurisdiction.
9. The contractor shall engage a qualified testing agency to perform tests and inspections as listed in other Project Specifications, but as a minimum shall include at least four of each type and size of installed anchors and fasteners selected by Architect. Schedule tests with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.

Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members as required. Test to 90 percent of rated proof load of device. Prepare and submit test and inspections reports.

- AA. Trenching and Backfilling: Contractor shall be responsible for trenching and backfilling. Refer to Trenching and Backfilling section of the specifications for complete requirements.

PART 3 - EXECUTION

3.1 PREPARATION AND INSTALLATION

A. Installation of Conduit and Outlet Boxes:

1. All conduit installed in the dry walls or ceilings of a building shall be steel tube (EMT), aluminum tube (EMT), or Intermediate Metal Conduit (IMC). Flexible conduit shall not be used in lieu of EMT, IMC or rigid conduit except as noted herein.
2. Galvanized rigid conduit (GRC) or intermediate metal conduit (IMC) shall be used as follows:
 - a. When noted on the drawings.
 - b. When considered exposed to damage by the local AHJ.
 - c. When installed in wet or damp locations and of a trade size where listed-Raintite fittings, connectors, couplings etc. are unavailable.
 - d. When required by NEC or CEC Article 517.13.
 - e. When installed in concrete and masonry. The use of ENT in CMU walls and parking structures may be allowed only as directed in writing by the Engineer. Request for ENT substitution must be made prior to bid and in accordance with pre-bid substitution requests requirements of these specifications.
3. Intermediate metal conduit (IMC), is approved for use in all locations as approved for GRC or steel-tube EMT and in accordance with NEC, or CEC where adopted, Article 342.
4. Flexible steel conduit shall only be permitted to be used at light fixture outlets and connections to vibrating electrical equipment. Except when concealed in walls or other structural elements, all flexible steel conduit runs shall be less than 6'-0". All outdoor installation shall be made using liquid-tight flex with approved fittings. Include a separate insulated green ground conductor sized per NEC in each conduit. Other uses of flexible conduit shall be allowed only as approved in writing by the Engineer.
5. Flexible liquidtight conduit shall be installed in lieu of the flexible steel; where required by the NEC, or CEC where adopted, in damp and wet location, where

exposed to weather, in refrigerated area (65°F or less), and/or between seismic joints. All rotating electrical equipment shall be supplied with flexible, liquid-tight conduit with appropriate slack and shall not exceed thirty-six (36) inches. Include a separate insulated green ground conductor sized per NEC in each conduit. Other uses of liquidtight flexible conduit shall be allowed as approved in writing by the Engineer on a case by case basis.

6. Rigid metallic conduit installed underground or embedded in concrete shall be 1" trade size minimum and shall be wrapped with 20 mil. Polyvinylchloride plastic tape, PVC conduit installed underground or embedded in concrete shall be 3/4" minimum trade size.
7. Where required for providing an electrical circuit protective system to comply with NEC, or CEC where adopted, Articles 695 and 700 utilize UL Listed 2-hour fire-rated, MC cable or UL Listed 2-hour fire-rated RHH/RHW conductors in conduit.
8. Conduit shall be run so as not to interfere with other piping fixtures or equipment.
9. The ends of all conduit shall be cut square, carefully reamed out to full size and shall be shouldered in fitting.
10. No running threads will be permitted in locations exposed to the weather, in concrete or underground. Special union fittings shall be used in these locations.
11. Where conduit is underground, under slabs or grade, exposed to the weather, or in wet locations, make joints liquid tight and gas tight.
12. All metal conduit in masonry and concrete and where concealed under floor slabs shall have joints painted with thread compound prior to makeup.
13. PVC conduit shall not be run in walls except where approved by the Engineer prior to bid in limited instances that may include concrete or CMU walls used in site retaining, parking structures, or exterior equipment yard or enclosure walls, etc.
14. Where conductors enter a raceway or a raceway in a cabinet, pull box, junction box, or auxiliary gutter, the conductors shall be protected by a plastic bushing type fitting providing a smoothly rounded insulating surface.
15. Where conduit extends through roof to equipment on roof area, the Contractor shall provide flashing material compatible with the roofing system as required by the roofing specifications or as required by the Owner's roof warranty. This flashing shall be delivered to the roofing Contractor for installation. The actual location of all such roof penetrations and outlets shall be verified by the Architect/Owner. Contractor to verify type of flashing prior to bid and include all costs.
16. All conduit shall be supported at intervals not less than 6'-0" and within 12" from any outlet and at each side of bends and elbows. Conduit supports shall be galvanized, heavy stamped, two-hole conduit clamp properly secured.

17. Where conduit racks are used the rack shall consist of two piece conduit clamps attached to galvanized steel slotted channels, properly secured via threaded rods attached directly to the building structure.
18. Nail-in conduit supports, one-piece set screw type conduit clamps or perforated iron for supporting conduit shall not be used.
19. Seismic Conduit Support:
 - a. All conduit shall be supported in such a manner that it is securely attached to the structure of the building. Attachment is to be capable of supporting the tributary weight of conduit and contents in any direction. Maximum spacing of support and braces are to be as follows:
 - 1) CONDUIT SIZE MAXIMUM SPACING
 - 2) 1/2" to 3" 6'-0"
 - 3) 3-1/2" to 4" 8'-0"
20. All conduit runs shall be installed parallel or perpendicular to walls, structural members, or intersection of vertical planes and ceilings. Field made bends and offset shall be avoided where possible. Crushed or deformed raceway shall not be installed.
21. Open knockouts in outlet boxes only where required for inserting conduit.
22. Locate wall outlet of the same type at same level in all rooms, except where otherwise noted.
23. Outlet boxes on metal studs shall be attached to metal hangers, tack welded or screwed to studs; on wood studs attachment shall be with wood screws, nails are not acceptable.
24. Recessed boxes shall not be mounted back-to-back in any wall; minimum offset shall be 24 inches.
25. Junction Boxes that do not contain any device(s) shall be located in storage rooms, electrical closets, or above accessible ceilings, not in hard lid ceilings or other forms of inaccessible ceilings. Place boxes which must be exposed to public view in a location approved by the Owner's Project Manager. Provide covers or plates to match adjacent surfaces as approved by the Owner's Project manager.
26. Surface mounted pull boxes, terminal cabinets, junction boxes, panel boards etc., shall be attached to walls using appropriate screws, fasteners, backing plates, stud blocking etc., as detailed on architectural and/or structural drawings. If architectural and/or structural drawings are not provided on the project, Contractor shall provide all necessary mounting hardware and backing support to comply with local building code requirements and any additional requirements imposed by the local Authority-Having-Jurisdiction.

27. Sleeves shall be installed where conduit passes through masonry or concrete walls and shall be 24 gauge galvanized steel no more than 1/2" greater in diameter than the outside diameter of the conduit. When located in non-rated structures, caulk conduit sleeve with stone wool and waterproof below grade. When located in fire rated structures, provide UL listed fire stopping system. See fire stopping section of this specification for additional requirements.
28. All boxes shall be covered with outlet box protector, Appleton SB-CK, or similar device/method to keep dirt/debris from entering box, conduit or panels. If dirt/debris does get in, it shall be removed prior to pulling wires.
29. All boxes installed outdoors shall be suitable for outdoor installations, gasketed, screw cover, and painted as directed by the Architect with weatherproof paint to match building.
30. All conduit entries to outdoor mounted panels, cabinets, boxes, etc., shall be made using Myers "SCRU-TITE" hubs Series ST.
31. Provide nylon or a 1/8-inch O.D. polyethylene rope, rated at 250 pounds tensile strength, in all conduits more than 5 feet in length left empty for future use. Not less than 5 feet of rope shall be left at each end of the conduit. Tag all lines with a plastic tag at each end indicating the termination/stub location of the opposite end of the conduit.
32. All multiple conduit runs within suspended ceilings shall be suspended from building structure by means of unistrut hangers/racks, Conduit shall not be allowed to lay on ceiling or be supported from ceiling suspension wires or other suspension system. Support conduit to structure above suspended ceilings 8" minimum above ceiling to allow removal of ceiling tile. Maintain two-inch clearance above recessed light fixtures
33. All exposed conduits and support hardware shall be painted to match the finish of the wall or ceiling to which it is supported.
34. Where conduits or wireways cross seismic joints, provide approved flexible conduit connection or approved expansion/deflection fitting to allow for displacement of conduit in all three axes. Connection shall allow for movement in accordance with design of seismic joint. Non-flexible raceways crossing expansion joints or other areas of possible structural movement shall make provision for 3-way movement at such points by means of expansion/deflection fittings. Fittings shall be installed in the center of their axes of movement and shall not be deflected to make part of a conduit bend, or compressed or extended to compensate for incorrect conduit expansion/deflection fittings(s) complete with ground jumpers. Where necessary, provide approved expansion joints to allow for thermal expansion and contraction of conduit(s). Install expansion joints complete with ground jumpers.
35. Seal all conduits where termination is subject to moisture or where conduit penetrates exterior wall, floor or roof, in refrigerated areas, classified (hazardous areas) and as indicated on the drawings.

36. Except as otherwise indicated on the Drawings or elsewhere in these specifications, bends in feeder and branch circuit conduit 2 inches or larger shall have a radius or curvature of the inner edge, equal to not less than ten (10) times the internal diameter of the conduit. Except where sweeping vertically into a building, and where sweep radius equals ten (10) times conduit diameter, underground communications and building interconnect conduits 3 inches or larger shall have a minimum 12'-6" radius or curvature of the inner edge. For the serving utilities, radius bends shall be made per their respective specifications.
37. Tag all empty conduits at each accessible end with a permanent tag identifying the purpose of the conduit, footage end-to-end, and the location of the other end. In wet, corrosive outdoor or underground locations, use brass, bronze, or copper 16 gauge tags secured to conduit ends with #16 or larger galvanized wire. Inscribe on the tags, with steel punch dies, clear and complete identifying information.
38. The following additional requirements shall apply to underground conduits:
 - a. Underground conduit shall be Schedule 40 PVC (polyvinyl chloride) unless otherwise indicated elsewhere in these specifications or as required per NEC, or CEC where adopted Article 517.13.
 - b. For all communications conduits 2 inches and larger and feeders 100A or greater, provide with a minimum 3 inch, (2,000 LB) concrete envelope, 2" inch minimum separation between conduits, installed at depth of not less than 24" below grade. (Provide concrete encasement and/or greater minimum conduit depth as required by the Utility Companies.) Conduit separation within a duct bank shall be maintained using plastic spacers located at 5'-0" intervals. Where power and communication conduits are run in a common trench, a 12 inch minimum separation shall be maintained between power and communication conduits or as required by Utility Companies. Where concrete encasement is not required by serving utilities for a utility-only duct bank, provide free draining sand bedding suitable to achieve 95% relative compaction based on ASTM D1557 using 6" lifts or directed by Utility Company Standards.
 - c. In all cases, where any conduit(s) pass under a building slab or footing, the electrical Contractor will provide a Bentonite clay or concrete barrier that conforms to the height and width of the trench excavation extending a minimum of 24" on either side of the foundation. In all cases, where conduit(s) pass through a sleeve in a footing or other foundation element, the electrical Contractor will provide a Bentonite clay or concrete barrier between the sleeve and the conduit(s) surrounding the conduit(s) for the entire depth of the sleeve. The barrier is required to prevent passage of moisture under or through the slab or footing via the trench or sleeve.
 - d. Where underground conduit passes under a building slab, concrete encasement may not be required, except as required above, contact the Engineer for written direction prior to omitting any encasement.

- e. Underground conduits, which terminate inside building(s) below grade, such as in a basement level, or which slope so that water might flow into interior building spaces, shall be sealed at the point of penetration with a modular conduit seal (Link-Seal or equal by Rox Systems). Conduit/conduit sealing system penetrations of waterproofing membranes/systems on existing structures shall be completely restored as required to maintain membrane/system manufacturer and installer warranty for the installation. All conduits shall be provided with a 4% slope away from buildings. All conduits shall be installed such that the water cannot accumulate in the conduit and such that water drains into the nearest manhole, pull box or vault – not into the facility. In instances where grade changes or elevation differences prevent sloping of conduit away from a building into the nearest manhole, pull box or vault or where accumulation of water in a manhole, pull box or vault may result in water traveling into the facility, conduits shall be sealed internally at each end of each conduit using conduit sealing bushing, sized as required for the conductors contained within the conduit (O-Z Gedney #CSBG 100psig withstand or equal). In all cases, install plugs or caps in spare (empty) conduits at both ends of each conduit (Jackmoon or equal) preventing both water and gas from entering the facility via the conduits.
- f. Include a separate insulated green ground conductor sized per NEC, or CEC where adopted, in each underground electrical feeder/branch circuit.
- g. All underground conduits with circuits rated at 40As or greater and all underground communications conduits shall be provided with a metallic marker tape located 12 inches below the finished grade.
- h. Where underground conduits sweep into/through slabs, utilize PVC 90 degree sweeps that transition, via female PVC adapter to GRC coupling mounted flush in slab. GRC couplings shall be 1/2 lap taped with 20-mil tape. If the distance of the conduit run between a sweep and the next connecting sweep, pullbox, vault or manhole exceeds 150 ft then the sweep shall be concrete encased. Exceptions:
 - 1) Communications conduits shown terminating at a finished floor shall have an additional 4" high GRC nipple equipped with a bushing, removable conduit plug, labeling tag and pull rope. Tie off pull rope to conduit plug.
 - 2) Utility conduit sweeps shall be installed per the requirements of the respective utility company.
- i. All PVC conduit shall be glued for a water and gas tight installation. The Contractor shall use appropriate solvent on all joints prior to gluing conduit and fittings together.
- j. All underground conduit work shall conform to the Federal, State and Local Safety Orders or Rules regarding excavations, trenches and related earthwork. For projects in California, refer to the California Code of

Regulations, Title 8, Construction Code Sections 1540 and 1541 for additional requirements.

39. Installation of Metal Clad (MC) Cable (when use is permitted in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section, generally located on the symbols list drawing).
- a. Provide J-box above accessible ceiling prior to running MC cable within partitions or walls. J-box shall be permanently labeled with panel identification and circuit numbers contained within.
 - b. Overhead MC cable runs shall generally follow building lines to provide a neat and workmanlike installation.
 - c. Provide code-sized J-boxes to accommodate MC cable splicing in general. For systems furniture poke-through feeds utilizing MC cable, transition from MC cables to conduit and wire near the panelboard in the TI accessible ceiling space on the floor below the panel board via code-sized gutter(s). Utilize UL listed, insulated barrier strips with recessed screw heads (Ideal #89-6?? Series or equal) fastened within the gutter(s), terminate MC conductors on one side of the strips(s) and individual conductors in conduit from the panelboard(s) on the other side of the strip(s). Label each terminal strip(s) with panel designation. Label each phase conductor with circuit number using wire markers (Ideal or equal). Wire nuts are not an acceptable alternative to the terminal strips in these underfloor transition locations. Provide (1) spare 3/4" conduit from each gutter to its respective panelboard.
 - d. MC cable shall not run directly into panelboards, distribution boards or electrical rooms.
 - e. MC cabling shall be provided with its own code-approved ceiling support wires, cable hangers, individual spring steel support clips, steel trapeze hangers, threaded rods or dedicated #10 AWG drop wire. Cable supports shall be fastened to concrete slabs, beams, joists or other structural members of the building. In no case shall MC cable rest on ceilings, suspended ceilings or structures. Do not support MC cable using ceiling support wires. The use of nylon cable ties to support MC cable is not allowed.
 - f. Use lock or spring nut MC cable fittings.
 - g. Cable runs shall be continuous from wiring device to wiring device – no intermediate splicing J-boxes allowed.
 - h. When terminating or splicing at a junction, outlet, or switch box, cut the cable with an armored cable rotary cutter such that 6-inches of free conductors remain for connections or splices. Use screw-in or spring lock connector and ensure a proper bonding by firmly tightening the connector to both the box and cable. Insert an anti-short bushing at cable ends to protect conductors from abrasion and use insulated connectors.

- i. MC cable bend radius shall not be less than seven (7) times the external diameter of the cable.
 - j. MC cables passing through fire-rated walls or floors shall be firestopped as required with a UL listed system. See firestopping requirements outlined elsewhere in this specification for additional requirements.
 - k. Installation shall not exceed code requirements for total current carrying conductors in multiple MC Cable runs bundled together into a single MC cable hanger or strap, unless support device is specifically listed for such purpose. Neutrals shall be counted as current carrying conductors.
 - l. Maintain MC Cable clearance of at least 6 inches from hot water and any other high temperature pipes. Maintain at least 12-inches clearance between MC cable(s) and telecommunication conduits and cables. MC cable shall cross telecommunication cables and conduits at right angles.
 - m. MC cabling shall not be run through exposed ceilings, where open grid conditions exist, exposed on walls, or exposed to view. See Power Plan and Lighting Plan General Notes for additional requirements.
40. Installation of Electrical Nonmetallic Tubing (ENT) Cable (when use is permitted in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing).
- a. When approved for use in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section, generally located on the symbols list drawing, 1/2" and 3/4" trade size ENT shall be allowed for concealed lighting branch circuits, receptacle branch circuits and miscellaneous signal system circuits within concrete floors, walls and columns within parking structures.
 - b. ENT conduit shall meet the requirements of Underwriters Laboratories Standards 1479 and 1655, NEMA TC-13, and be UL-listed.
 - c. All ENT conduit, ENT fittings, ENT boxes and ENT accessories shall be UL listed and manufactured by the same manufacturer so as to form a complete ENT system. ENT systems shall only be used if they are listed for use in fire resistance rated concrete floors and ceilings with resistance ratings as indicated elsewhere in the project plans. ENT system shall comply with NEC, or CEC where adopted, Article 362.
 - d. All ENT fittings and ENT boxes shall be concrete-tight listed without the use of tape. Additionally, ENT fittings shall be constructed of high impact PVC and able to resist ENT conduit pull out forces of a minimum of 175 lbs. ENT fittings with fewer than 6 locking tabs for ENT connection shall utilize manufacturer approved glue as additional protection from fitting/conduit separation. ENT conduit to rigid conduit transition fittings shall be equipped with set screw fittings on the rigid conduit side of the fitting. ENT to metal box fittings shall be equipped with a threaded end and lock washer.

- e. Where tubing enters a box, fitting, or other enclosure provide a bushing or adapter to protect conductors from abrasion unless the box, fitting, or enclosure design provides equivalent protection.
- f. ENT junction boxes shall have brass screw inserts and shall be rated to support lighting fixtures weighing less than 50 lbs.
- g. Concrete tight metal boxes shall be used to support pendant hung fixtures or fixtures over 50 lbs.
- h. ENT shall be provided in continuous lengths between junction boxes without use of in-line splices or connectors and shall be clearly marked/labeled at least every 10 feet.
- i. All ENT conduit containing electrical branch circuits shall contain a code-sized equipment ground conductor.
- j. ENT shall transition to EMT, IMC, RMC, or rigid PVC, as appropriate or as called out elsewhere in this specification, for all exposed conduits within/on/under a parking structure.
- k. ENT shall transition to appropriately sized PVC expansion joint(s) at all structure expansion or seismic joints.
- l. ENT shall be securely fastened and supported every 2 – 3 ft. and within 1 ft. of every junction box and fitting to prevent movement and sag.
- m. ENT shall be routed straight without sags, or excessive bending. Where bends are required, comply with Table 362.24 of the NEC for minimum radius of bends. Number of bends shall not exceed quantity allowed by code where used for power and lighting branch circuit and/or feeder conductors. Where utilized for communications system conductors (phones, data cabling, etc.) number of bends shall not exceed the equivalent of (2) 90 degree bends with conduit length no more than 100 feet without installation of a TIA 569-compliant pull box.
- n. Separation of ENT from fittings, excessive sags, or deflections in ENT runs that prevent pulling of wire and other ENT system product or system installation failures/errors shall be corrected by saw cutting and patching as necessary at no additional cost to the Owner. Use of surface mounted conduits and junction boxes as a repair method is unacceptable.
- o. Empty ENT runs shall be provided with a nylon pull string.
- p. Coordinate installation of raceway with structural steel and other structural members. Do not cut, notch or otherwise alter structural members without obtaining approval in writing from the Structural Engineer of record.
- q. No more than (2) 3/4" ENT conduits may cross each other within a horizontal concrete slab without obtaining approval in writing from the Structural Engineer of record.

B. Installation of 600-Volt Conductors:

1. All electrical wire, including signal circuits, shall be installed in conduit.
2. All circuits and feeder wires for all systems shall be continuous from over current protective device or switch to terminal or farthest outlet. No joints shall be made except in pull, junction or outlet boxes, or in panel or switchboard gutters.
 - a. Utilize preinsulated "winged" spring type connectors, 3M Company "Performance Plus" #O/B or #R/Y or equal as required for splices and taps in conductors #6 AWG and smaller. When a spring connector is used in an underground environment or when subject to moisture, utilize a 3M Company Scotchcast 3507G epoxy resin connector sealing pack to seal the spring connector. THE USE OF PUSH-WIRE CONNECTIONS (e.g. "WAGO" OR EQUIVILENT) IS STRICTLY PROHIBITED.
 - b. Wires #4 AWG and larger AWG shall be joined together as follows:
 - 1) When located in an underground environment or when subject to moisture, the splice shall be made with compression connector and sealed by a 3M, or equal, PST cold shrink connector insulator.
 - 2) When located in an interior environment, the splice shall be made with an IlSCO or equal dual rated, insulated splice-reducer connector or multi-tap connector-listed for use with 75/90 degree Celsius rated conductors.
 - c. Connections to busbar shall be made with dual-rated copper/aluminum one-piece compression lugs. Paralleled conductor connections shall be by mechanical lugs.
3. Thoroughly clean all conduit and wire-ways and see that all parts are perfectly dry before pulling any wires.
4. Install UL approved fixture wire from all lighting fixture lamp sockets into fixture outlet or junction box.
5. For 20A branch circuit wiring, increase #12 conductors to #10 for 120 volt circuits longer than 100 feet and for 277V circuits longer than 150 feet.
6. Conductor Support: Provide conductor supports as required by codes and recommended by cable manufacturer. Where required, provide cable supports in vertical conduits and provide lower end of conduit with a ventilator.

C. Grounding/Bonding:

1. Provide grounding and bonding for entire electric installation as shown on plans, as listed herein, and as required by applicable codes. Included, but not limited to, are items that require grounding/bonding:
 - a. Conduit, Raceways and Cable Trays.

- b. Neutral or identified conductors of interior wiring system.
 - c. Panel boards, Distribution Boards, Switchgear and Switchboards.
 - d. Non-current carrying metal parts of fixed equipment.
 - e. Telephone distribution equipment.
 - f. Transformers, Inverters, UPS, PDU, RDC, Transfer Switch and Generator Systems.
 - g. Raised Flooring.
 - h. Exposed metal in maintenance holes, hand holes.
 - i. Lightning Protection Systems and Antennas.
 - j. Metal piping installed in or attached to a building/structure.
 - k. Metallically isolated structural steel.
 - l. Metallically isolated underground metal water piping.
 - m. Elevator hydraulic piston/lift case.
2. In multi-occupancy buildings, Contractor shall bond metal water piping systems instated in, under or attached to a building and/or structure serving individual occupancies where the piping system(s) are metallically isolated from each other. Per NEC, or CEC where adopted ART. 250.104(A)(2) and (4), the bonding conductor shall be sized per Table 250.122 and connected to the switchboard/panel board serving that suite/occupancy.
3. Use of Ground Rods: Furnish and install required number of 3/4" x 10' copper clad ground rods to meet specified resistance, all required grounding wires, conduit and clamps. The size of the grounding conductors shall be not less than that set forth in the latest edition of the California Code of Regulations, Title 24, State of California and NEC (CEC, where adopted), unless otherwise indicated. Rods shall be installed such that at least 10 feet of length is in contact with the soil. Where rock bottom is encountered, the electrode shall be driven at an oblique angle not to exceed 45 degrees from vertical or shall be buried in a trench that is at least 30 inches deep. The upper end of the electrode shall be flush with or below ground level unless the above ground end and the grounding electrode conductor attachments are protected against physical damage. Unless otherwise noted, connection to the grounding electrode conductor may be by compression type or exothermic process connector. Mechanical connectors shall not be used.
4. Grounding System Connection:

- a. Compression connectors shall be unplated copper, manufactured by Burndy, or approved equal, designed specifically for the intended connection.
 - b. Exothermic weld-type connectors shall be 'Cadweld' manufactured by Erico Products, or approved equal, designed specifically for the intended connection.
 - c. Mechanical connectors shall not be used.
- 5. Isolated Ground Receptacles shall have an insulated ground wire connected between the receptacle and the panelboard isolated ground bus. Unless otherwise noted, this ground wire shall not be grounded at any other point and shall be distinguished from other ground wires by a continuous yellow stripe.
 - 6. Provide separate green equipment ground conductor in all electrical raceways to effectively ground all fixtures, panels, controls, motors, disconnect switches, exterior lighting standards, and noncurrent carrying metallic enclosures. Use bonding jumpers, grounding bushings, lugs, busses, etc., for this purpose. Connect the equipment ground to the building system ground. Use the same size equipment ground conductors as phase conductors, up through #10 AWG. Use NEC (or CEC where adopted) Table 250.122 for conductor size with phase conductors #8 and larger, if not shown on the Drawings.
 - 7. Clean the contact surfaces of all ground connections prior to making connections.
 - 8. Ductwork: Provide a flexible ground strap, No. 6 AWG equivalent, at each flexible duct connection at each air handler, exhaust fan, and supply fan, and install to preclude vibration.
 - 9. Motors: Connect the ground conductor to the conduit with an approved grounding bushing, and to the metal frame with a bolted solderless lug. Bolts, screws and washers shall be bronze or cadmium plated steel.
 - 10. Building grounding system resistance to ground shall not exceed 25 ohms unless otherwise noted and should be confirmed by testing.
- D. Line Voltage and Low Voltage Power Supplies to all Mechanical Equipment Including Plumbing, Heating and Air Conditioning Units:
- 1. An electric power supply, including conduit, any necessary junction and/or outlet boxes and conductors and connection shall be furnished and installed by the Contractor for each item or mechanical equipment.
 - 2. Power supplies to individual items of equipment shall be terminated in a suitable outlet or junction box adjacent to the respective item of equipment, or a junction box provided by the manufacturer or the equipment and directed by the Mechanical Contractor. Allow sufficient lengths of conductor at each location to permit connection to the individual equipment without breaking the wire run.

3. The location of all conduit terminations to the equipment is approximate. The exact location of these conduit terminations shall be located and installed as directed by the Mechanical and Plumbing Contractor.
 4. Provide power supplies to all plumbing and mechanical equipment, including but not limited to, equipment furnished and installed by Owner or Contractor such as heating and air conditioning equipment, pumps, boilers, auto valves, water coolers, trap primers etc. The installation shall produce a complete and operable system.
 5. Unless otherwise noted, the Contractor shall furnish and install all conduit, boxes, wires, etc., for line voltage wiring and low voltage wiring.
 6. It is the Contractor's responsibility to verify with the drawings of other trades regarding the extent of his responsibility for mechanical equipment. The bid must include a sum sufficient to cover the cost of the installation.
 7. The location of all power supply connection and/or terminations to the mechanical equipment is approximate. The exact locations of these terminations shall be verified with other trades during construction.
- E. Prefabricated Equipment: Installation of all prefabricated items and equipment shall conform to the requirements of the manufacturer's specifications and installation instruction pamphlets. Where code requirements affect installation of materials and equipment, the more stringent requirements, code or manufacturer's instructions and/or specifications, shall govern the work.
- F. Firestopping:
1. The Contractor shall be responsible for furnishing all material, labor, equipment, and services in conjunction with the selection and installation of a complete, fully functioning, code compliant, UL-listed, fire stop assembly/system(s) as required by project conditions.
 2. Each fire stop assembly/system shall have an "F" and/or "T" rating as required by each condition requiring fire stopping. Each fire stop assembly/system shall have a current UL listing, as indicated in the latest edition of the UL Fire Resistance Directory. Contractor shall verify acceptability of all fire stopping methods and system selections with the authority having jurisdiction prior to installation. The Contractor shall install each fire stop assembly/system in accordance with the manufacturer's printed instructions.
 3. Each fire stop assembly/system shall be labeled with fire stop manufacturer-furnished label on each side of the fire stopping systems depicting UL # etc.
- G. Housekeeping Pads
1. Provide a minimum 3" high housekeeping pad above finished floor/finished grade for all floor-mounted switchgear, switchboards, distribution boards, transformers, motor control centers, etc., flush with the face of the equipment. Located in mechanical central plant(s), other mechanical spaces, and located outdoors,

pads shall be flush with the face of the equipment. Confirm pad dimensions with local inspector prior to forming pad to ensure any local code interpretations/conditions are met regarding housekeeping pads.

2. Unless otherwise noted above, provide a minimum 1-1/2" high housekeeping pad above finished floor/finished grade for all interior floor-mounted switchgear, switchboards, distribution boards, transformers, motor control centers, transfer switches etc., flush with the face of the equipment. All housekeeping pad heights are as measured from finished floor or grade. Confirm pad dimensions with local inspector prior to forming pad to ensure any local code interpretations/conditions are met regarding housekeeping pads.
3. Provide a 1-1/2" high housekeeping pad above finished floor/finished for service equipment. Prior to pad rough-in, Contractor shall verify serving utility company's maximum meter height requirements and, if necessary, adjust height of housekeeping pad to comply with those requirements. In indoor applications, the pad shall be flush with the face of the switchgear. In outdoor applications, the housekeeping pad shall extend a minimum of 4 feet from the front of switchgear/switchboard's weatherproof enclosure. Confirm pad dimensions with local inspector prior to forming pad to ensure any local code interpretations/conditions are met regarding housekeeping pads.
4. All housekeeping pads located in, on or attached to a building shall be seismically braced/connected to the building structure.

END OF SECTION

SECTION 27 10 00

STRUCTURED CABLING SYSTEM

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. The work under this section includes all final design, material, equipment, supplies, labor, testing, and accessories required to furnish and install a complete Structured Cabling System (SCS) as indicated on the drawings and as specified herein. These systems shall be defined as all cables, equipment, products, and etcetera, as indicated on the drawings and mentioned in these specifications.
- B. It is the intent of the Drawings and Specifications, which are presented in a "design-build" format, for the Contractor to design, provide and install a complete, fully operational, and tested system.
- C. All miscellaneous system components including, but not limited to, cables, cable supports, termination equipment, punch blocks, patch panels, patch cords, device outlets, ladder runway, backboards, equipment racks, equipment cabinets, enclosures, terminal cabinets, equipment grounding, and any other related items shall be furnished and installed complete under this section, such that the system shall perform all functions listed herein in compliance with all of the specified requirements.
- D. Schedule is paramount to the project's success. With this, the Contractor will have to be a team player, continually working with the team to facilitate expeditious design, procurement, and construction processes.
- E. This project will be performed in a phased construction format. Each phase of construction will be completely installed, labeled, and tested, to the greatest extent physically possible, before moving to the next phase.
- F. It is a mandatory requirement that a single Contractor perform the work described in the following specification sections:
 - 1. Section 27 10 00 Structured Cabling System

1.2 RELATED WORK, STANDARDS, DOCUMENTS AND PUBLICATIONS

- A. Each agency's relative codes, standards, and recommended practices apply to the voice/data cabling systems and their components as specified herein:
 - 1. Building Industry Consulting Service International (BICSI)
 - a. Telecommunications Distribution Methods Manual (TDMM) – latest edition.
 - b. Customer-Owned Outside Plant Design Manual (CO-OSP) – latest edition.
 - 2. Federal Communications Commission (FCC)

- a. FCC Part 68 Rule
3. American Society for Testing and Materials (ASTM)
 - a. E814-02 Standard Test Method for Fire Tests of Through-Penetration Fire Stops
4. International Electrotechnical Commission (IEC)
 - a. IEC 61935-01 Generic Cabling Systems - Specification for the testing of balanced communication cabling in accordance with ISO/IEC 11801 Part 1: Installed Cabling
 - b. IEC 61935-02 Generic Cabling Systems - Specification for the testing of balanced communication cabling in accordance with ISO/IEC 11801 Part 2: Patch Cords and Work Area Cords
5. Institute of Electrical and Electronics Engineers (IEEE)
 - a. IEEE 802 Specification for Local Area Networks, latest edition.
 - b. IEEE 802.3an Specification for 10GBASE-T Ethernet, latest edition.
 - c. ANSI/IEEE C62.41 – Guide on the Surge Environment in Low-Voltage (1000V or less) AC Power Circuits, latest edition.
6. International Organization for Standardization (ISO)
 - a. ISO/IEC 11801 Information Technology – Generic Cabling for Customer Premises, latest edition.
7. National Fire Protection Association (NFPA)
 - a. ANSI/NFPA-70 National Electric Code – Current version as adopted by AHJ(NEC), California Electric Code.
 - b. ANSI/NFPA-75 Standard for the protection of information technology equipment
8. National Electrical Manufacturers Association (NEMA)
9. Occupational Safety and Health Administration (OSHA)
10. Telecommunications Industry Association (TIA)
 - a. Optical Fibers Suitable for Manufacturing OM4 Cabled Optical Fiber.
 - b. TIA-526-7 Optical Power Loss of Installed Single-Mode Fiber Cable Plant.
 - c. TIA-526-14-B Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant; IEC 61280-4-1 Edition 2, Fiber-Optic Communications

Subsystem Test Procedure- Part 4-1: Installed Cable Plant- Multimode Attenuation Measurement.

- d. TIA-568-E.0 Telecommunications Cabling for Customer Premises, latest edition.
- e. TIA-568-E.1 Commercial Building Telecommunications Cabling Standard
- f. TIA-568-E.2 Twisted-Pair Telecommunications Cabling and Components Standard, latest edition.
- g. TIA-568-E.3 Optical Fiber Cabling Components Standard, latest edition.
- h. TIA-568-E.4 Broadband Coaxial Cabling and Components Standard
- i. TIA-569-E Telecommunications Pathways and Spaces, latest edition.
- j. TIA-598-E Optical Fiber Cable Color Coding.
- k. TIA-606-D Administration Standard for Commercial Telecommunications Infrastructure, latest edition.
- l. TIA-607-E Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, latest edition.
- m. TIA-758-B Customer-Owned Outside Plant Telecommunications Infrastructure Standard, latest edition.
- n. TIA-862-C Building Automation Systems Cabling Standard, latest edition.
- o. TIA-942-C Telecommunications Infrastructure Standard for Data Centers
- p. TIA-1152 Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling, latest edition.

11. Underwriters Laboratories Standards (UL)

- a. UL 5 Surface Metal Raceways and Fittings, latest edition.
- b. UL 5A Nonmetallic Surface Raceways and Fittings, latest edition.
- c. UL 5B Strut-Type Channel Raceways and Fittings, latest edition.
- d. UL 5C Surface Raceways and Fittings for Use with Data, Signal, and Control Circuits, latest edition.
- e. UL 514A Metallic Outlet Boxes, latest edition.
- f. UL 514B Conduit, Tubing, and Cable Fittings, latest edition.
- g. UL 514C Nonmetallic Outlet Boxes, Flush-Device Boxes, Covers, latest edition.

- h. UL 514D Cover Plates for Flush-Mounted Wiring Devices, latest edition.
- i. UL 1685 Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables, latest edition.
- j. UL 1863 Communications-Circuit Accessories, latest edition.

12. Intertek Testing Services ETL SEMKO (ETL)

- B. The Contractor shall be responsible for obtaining and utilizing the latest Structured Cabling, Architectural, Security and Electrical plans.

1.3 GENERAL REQUIREMENTS

- A. Manufacturer: The term “manufacturer” shall be defined as the company, or group of companies, that produces the products meeting the requirements of Section 2 of this document. The manufacturer shall have a minimum of seven (7) years’ experience in manufacturing products of this type and shall be ISO 9001 Certified. The products, summarized in this specification, shall be supplied by a single manufacturer, except for:
 - 1. Data racks and other hardware that is not defined as part of the copper cable channel test configuration by TIA-568-E.
 - 2. Fiber Optic Cable and Outside plant (OSP) fiber optic cable.
 - 3. Channel solutions consisting of cabling and connectivity hardware independently tested as by UL or ETL and that are listed Section 2 of this document.
 - 4. Cables manufactured by another manufacturer specifically called out on the drawings.
- B. Contractor: The term “Contractor” shall be defined as the company, or group of companies, that provides the products per Section 2 and installs the products per Section 3 of this document. The Contractor selected to provide the installation of this system shall be certified by the manufacturer in all aspects of design, installation and testing of the products described herein.
 - 1. The Contractor shall hold a valid State of California C-7 Low-Voltage license, shall have completed at least ten (10) projects of equal scope, shall have been in business of furnishing and installing systems of this scope and magnitude for at least the past five (5) consecutive years, and capable of being bonded to assure the Owner’s Project Manager of performance and satisfactory service during the guarantee period.
 - 2. The Contractor shall have a minimum of one (1) Registered Communications Distribution Designer (BICSI RCDD) and a minimum of one (1) BICSI Technician level installer on staff as full-time employees.
 - 3. All work shall be performed under the supervision of a company accredited and trained by the manufacturer and such accreditation must be presented with the

bid submittal. Contractor must be accredited a minimum of 180 days prior to bid submittal date.

4. The Contractor shall be a manufacturer's Authorized Installer and Warranty Station for the equipment offered and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment.
5. All personnel performing work on this project must have successfully completed the manufacturer's training course prior to performance of any work on this project. Accreditation will consist of individual employee certifications issued by the manufacturer. All personnel engaged in the testing of fiber optic and category-6A metallic premise horizontal and distribution systems must have successfully completed the test equipment manufacturer's training. Certification of such training must be presented with the bid submittal.
6. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of single mode and multimode fiber optic cable, Categories 6 and 6A metallic premise horizontal and distribution systems and have personnel who are manufacturer- trained in the use of such testing tools and equipment.
7. The Contractor shall hold all other licenses required by the legally constituted authorities having jurisdiction (AHJ) over the work.
8. The Contractor shall maintain and provide appropriate liability and worker's compensation insurance coverage.
9. The Contractor selected for this Project shall adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels in provisioning this Project.
10. For additional Contractor requirements, see Section 1.06 of this document in its entirety.

1.4 QUALITY ASSURANCE

- A. It is the intent of these specifications to establish an installation standard of quality for labor and materials.
- B. Products specified by a particular Manufacturer's name and followed by the words "no equal" shall be provided by the Contractor and no substitution will be accepted. These products shall be provided to match other products already in use on this site, in accordance with Public Contract Code 3400 (b)(2).
- C. For any proposed product substitution, or when the Contractor intends to include a "Substitution / Or-Equal" product in the bid pricing, the Contractor shall provide a "Substitution / Or-Equal Request" submittal to the Owner's Project Manager for review no later than ten (10) calendar days prior to Bid submittal. This report shall include *all* the following items:

1. Description of how the proposed product(s) will impact meeting the project completion date, indicate all item(s) with lead times and expected delivery date(s).
 2. Itemized cost comparisons between the proposed product(s) and the listed product(s).
 3. Detailed technical analysis of the electrical and mechanical specification differences between the proposed product(s) and the listed product(s).
 4. Provide either ETL "Verified" or UL "Verified" test lab documentation for the proposed product(s) and assemblies proposed.
 5. Proposed product identification, manufacturer literature (specifications and cut sheets).
 6. Name, address, and contact information of several (minimum of two) similar projects where the substituted product(s) have been used.
 7. Name, address, and contact information of the proposed product(s) manufacturer's local representative.
 8. Sample proposed product(s) manufacturer's component and application extended warranty. Detailed warranty requirements are described in Section 1.10 General System Product Warranty of this document.
- D. Failure to provide *all* items listed in Section 1.4.A.1 through 8 for review by the Owner's Design Team shall result in rejection of the substitution/or-equal request.
- E. The Contractor's bid shall include pricing for all specified products called out in the bid documents. The Contractor's bid shall also include alternate pricing for any proposed Substitution/Or-Equal products.
- F. The Owner's Design Team/Project Manager must approve any proposed product(s) substitution/or-equal item in writing. The Owner's Design Team/Project Manager reserves the right to require a complete sample of any proposed product(s) and may request a sample tested by an independent testing consultant to prove equality. The decision of the Owner's Design Team/Project Manager regarding equality of proposed product(s) items will be final.
- G. If a proposed product(s) is given final acceptance by the Owner's Project Manager, the Contractor shall reimburse the Owner's Design Team/Project Manager for the costs to review the proposed product(s) substitution(s), and for any additional engineering charges, and shall pay all charges of other trades resulting from this product's use, at no cost to the Owner.

1.5 GENERAL SUBMITTAL REQUIREMENT

- A. Submittals shall be presented and formatted per the guidelines in the Division 1 section of this bid package.

- B. All cut sheets shall represent the latest version, part number, and revision of the product. Where multiple products or part numbers appear on a page, a bold arrow or circle shall indicate which product or part numbers are to be used as part of the installation. The submittal shall include all descriptive pages associated with the product, not just the page showing the part number. Contractor submittal shall include a materials list. Cut sheets shall be numbered by and match page numbers of each item included on the material list.

1.6 PRE-INSTALLATION SUBMITTAL REQUIREMENTS

- A. Within fifteen (15) calendar days after the date of award of the Contract, the Contractor shall submit the following:
1. Submittal Binder: Submit one (1) hard copy and one (1) electronic copy of the complete Submittal Binder to the Project Engineer for review. The binder shall consist of five (5) major sections with each section separated by Index Tabs. Each page in the binder shall be numbered sequentially and shall be summarized in the Index.
 - a. The FIRST section shall include the following items:
 - 1) The TITLE SHEET which shall include the Submittal Date, Project Title and Address, Contractor's Name and contact information, and name of the Owner.
 - 2) The INDEX sheet which shall list each item included in the binder along with the page number where it may be found.
 - b. The SECOND section shall include the following items:
 - 1) CONTRACTOR'S LICENSE: A copy of the low voltage Contractor's valid State of California C-7 Low-Voltage license.
 - 2) PROOF OF EXPERIENCE: Proof (written documentation) that the low voltage Contractor has been regularly engaged in the business of low voltage contracting consisting of, but not limited to, engineering, fabrication, installation, and servicing of communication systems of the type specified herein for at least the past five (5) consecutive years.
 - 3) PENDING LITIGATION: Provide a statement summarizing any pending litigation involving any officer or principal of/or the company, the nature of the litigation and what effect the litigation may carry as it relates to this work in the worst-case scenario. Non-disclosure of this item, if later discovered, may result, at the Owner's discretion, in the Contractor bearing all costs and any cost related to the associated delays in the progress of the work.
 - 4) INSURANCE CERTIFICATES: Copy of low voltage Contractor's current liability insurance, workers compensation, and state industrial insurance certificates in conformance with the contract documents.

- 5) PROJECT LIST: A List containing at least ten (10) California installations completed within the last five (5) years by the low voltage Contractor that are comparable in scope and nature to that specified in the contract document. Provide up to date contact information for each project listed including contact name, title, email address and phone number.
 - 6) SERVICE CAPABILITY: Documentation indicating in detail that the low voltage Contractor has competent engineering, installation, service personnel and facilities with reasonable stock of service parts within 75 air miles of the job site. Do not submit a sales brochure as documentation.
 - 7) AUTHORIZATION LETTERS: Letters from the low voltage equipment manufacturer stating that the low voltage bidding Contractor is a Factory Authorized Distributor/Installer and is trained and certified for the equipment he proposes to use on this project and is licensed to purchase and install software required to provide the specified functions.
 - 8) CERTIFICATION: Copy of the following current BICSI certifications. Provide proof that the certificate holders are full time employees of the low voltage Contractor's local facility servicing this project and will be actively involved on site for the duration of this project.
 - a) BICSI RCDD, minimum of (1). Mandatory requirement: Shall be on site a minimum of one (1) day per workweek.
 - b) BICSI TECHNICIAN, minimum of (1). Mandatory requirement: Shall be on site a minimum of five (5) full 8-hour days per workweek.
 - 9) PROOF OF TRAINED PERSONNEL: Documentation that the Contractor has full time on-staff personnel, manufacturer trained and BICSI certified, for the equipment proposed for this project, and on-staff manufacturer trained and certified by the Test Equipment manufacturer in the proper use of the test equipment required on this project. Provide copies of all manufacturers' training/certification documentation, and Test Equipment manufacturer's training/certification documentation. Provide a statement that personnel meeting these qualifications are in the local facility and will be maintained at that facility throughout the project and the warranty period.
- c. The THIRD section shall contain a detailed bill of materials including the quantity, product Manufacturer, product part number, product description, and corresponding specification section number or drawing sheet number where that product is referenced. Also listed in the Contractor's bill of materials shall be each item of test equipment to be used to test the optical fiber, copper, and coax components. Include all patch cords and other specialized components. See example format below:

Description	Part #	Quantity	UoM	Spec	Test Equip.
CAT6A Station cable	Brand X #12345	100 boxes	1000ft/box	2.03	Fluke DTX- 1800

This information may be used by the Owner to evaluate the Contractor's general understanding of the project scope during the bid evaluation. Errors or omissions from this bill of material do not relieve the Contractor from providing all material, components, labor, and etcetera, as outlined in this specification and on the drawings to provide a complete and useable structured cabling system.

- d. The FOURTH section shall contain original manufacturer cut sheets for all the materials that meet the requirements listed in Section 2 of this specification and all materials described on the construction drawings. Also include manufacturer's cut sheets for all testing equipment to be used for completion of the project. All pages shall be numbered sequentially corresponding to the bill of materials. On each cut-sheet, provide an indicating arrow next to each part number of proposed material.
- e. The FIFTH section shall contain a designation schedule for each system component location and complete full size 30" x 42" (unless otherwise specified) bond drawings (shop drawings), showing system wiring plans. The professionally drafted drawings shall be generated on AutoDesk AutoCAD 2014 (or later) computer design software. These drawings shall also include:
 - 1) MDF and IDF Diagrams - Including:
 - a) Cable routing
 - b) Position of all devices, components, and apparatus
 - c) Detailed elevation layout of the wall field(s)
 - d) Labeling plan (see Owner labeling requirements)
 - 2) Site Plan – Including:
 - a) Conduit routing of all site conduits including size and quantity
 - b) Building designations
 - c) MDF and IDF locations
 - d) Campus cabling (if applicable) and conduit between MDF and IDF racks including cable type and quantity
 - 3) Work Area Floor Plans - Including:

- a) Detailed cable routes including cable type and quantity
 - b) Device locations and quantities with labeling
 - c) Work area labeling plan (see Owner labeling requirements)
 - 4) Cross Connect Documentation - Including:
 - a) Cross-connect records for all voice and data devices
 - b) Cross-connect records may be in either Excel or Word format
 - 5) Riser Distribution Plan
 - 6) Rack elevations of all MDF and IDF equipment
 - 7) 1/4-inch scale floor plans of all data rooms (MDF, IDF, MPOE, etcetera)
 - a) Identify all equipment racks, cabinets, terminals, cross connect locations, ground bus bar, and all other components in room(s).
 - 8) Cable Tray, Conduit, and Raceway Plans (if applicable)
 - a) Provide 1/4-inch scale ladder runway plan for all data rooms.
 - b) Provide scaled plans for all in-building conduit and raceway.
- B. Failure to comply with any of the requirements listed above may result in the rejection of the entire submittal package.

1.7 PROJECT DIRECTION

- A. Single Point of Contact: Contractor shall provide an English-proficient, single point of contact, i.e., Project Manager, to speak for the Contractor and shall provide the following functions:
- 1. Initiate and coordinate tasks with Owner's Project Manager, and others as specified by Owner's Project Manager.
 - 2. Provide day-to-day direction and on-site supervision of Contractor personnel.
 - 3. Shall be readily available to the Owner/Owner's Project Manager 24 hours a day / 7 days a week throughout the duration of the Project.
 - 4. Shall have full time cellular phone capability, and the ability to send/receive email correspondence, accessible by the Owner's Project Manager.
 - 5. Ensure conformance with all Contract provisions.
 - 6. Participate in weekly site project meetings and construction meetings.

7. Provide detailed and written weekly status reports to Owner's Project Manager. The content shall be substantive enough to bring about a full understanding of all situations current and situations future. Weekly reports shall include but are not limited to detailed progress report, RFI status log (Request for Information), Change Order Log (pending and approved), Project Addendum log, and a two-week look ahead work calendar. Each of the above must show assigned responsibilities and event history. Weekly reports shall include milestone information, resource updates (staff and materials), and any conditions or incidents that may impact the Project Schedule.
8. This individual shall remain as Project Manager for the duration of the project. The Contractor may change Project Managers only with the Owner's Project Manager's written approval.

1.8 PLANNING

- A. Planning meetings and schedule: Within fifteen (15) calendar days after the date of award of the Contract, an initial planning meeting will be held with the successful bidder to clarify all requirements (systems, services, distribution methods, etc.), identify responsibilities, and schedule the events that will transpire during the implementation of the project. Within seven (7) calendar days of this initial meeting, the Contractor shall provide a written report and project schedule to clearly document the events and responsibilities associated with the project. Contractor's project schedule shall conform to the overall Project Construction Schedule issued by the Construction Management Company or the Owner. Contractor is required to attend all planning and other construction meetings as requested by the Owner, Architect, or Engineer of Record.

1.9 POST INSTALLATION SUBMITTAL REQUIREMENTS

- A. Within fifteen (15) calendar days after the completion of work, the Contractor shall submit the following to the Owner's representative for review:
 1. Record Documentation:
 - a. Final Test Results – Test results for each cable indicating tests performed, results obtained, and values measured. Test results shall be provided in electronic format (CD or USB drive) with the associated application (if required) for viewing. Contractor shall provide individual test results for each cable tested, and a summary sheet listing all cables, test summary, lengths, and the total cable count. Provide test reports for all copper cables and fiber optic cables. Testing shall be conducted in accordance with Section 3.06 of this document.
 - b. As-Built Records – Contractor shall create and provide all backgrounds and floor plans in AutoCAD or Revit file format. As-builts shall be professionally drafted. Sheets with hand-written field markups shall be rejected. Sheet borders shall be either provided by, or approved by, the Architect.

Contractor's as-built records shall include all items described and listed in section 1.6.A.1.e of this document.

- B. After as-built submittal is approved by Owner, the Contractor shall provide two (2) sets of CDs and/or two (2) sets of USB drives containing all post-installation submittals and close out documentation in AutoCAD (or Revit) format; and in PDF, Word, or Excel formats as required elsewhere in this document.
- C. Warranty Documentation
 - 1. Contractor shall apply for all Manufacturers' Extended Warranties on behalf of the Owner. Contractor shall present to Owner all product Warranty documents per General System Product Warranty Section of this document. Warranty shall commence after final acceptance of System and Project Close Out by the Owner.

1.10 GENERAL SYSTEM PRODUCT WARRANTY

- A. The horizontal communications cabling system installed shall be eligible for coverage by minimum twenty 20-year Manufacturer's Warranty to the Owner.
 - 1. Horizontal copper channels shall be completed with Manufacturer's factory-terminated copper patch cords. Horizontal fiber optic channels shall be completed with Manufacturer's factory-terminated fiber optic patch cords.
 - 2. Approved product shall be listed on the most recent version of the applicable data sheets for each solution.
- B. Certified, manufacturer-trained Contractors shall provide labor, materials, and documentation in accordance with SCS manufacturer's requirements necessary to ensure that the Owner will be furnished with all Manufacturer's Warranties.
- C. The installed structured cabling system shall provide a warranty guaranteeing installed channel performance above the ANSI/TIA 568-E requirements for Category 6 and Category 6A cabling systems or ISO 11801 requirements for Class E, and/or Class Ea. Standards-compliant channel performance tests shall be performed in the field with a SCS manufacturer approved certification tester in the appropriate Channel Test configuration.
- D. Necessary documentation for warranty registration shall be provided to the manufacturer by the Contractor (within 10 days) following 100 percent testing of cables. Contractor shall submit test results to the SCS solution Manufacturer's warranty department, in the certification test analyzer's original software files. Contractor shall ensure that the warranty registration is properly submitted, with all required documentation within ten (10) days of project completion. Contractor must adhere to the terms and conditions of the respective manufacturer's warranty programs.
- E. Contractor shall ensure that the Owner receives the manufacturer issued project warranty certificate within thirty (30) calendar days of warranty registration.

- F. The warranty period shall commence upon the Owner's written Acceptance of Work Product (AWP).
- G. Cable Manufacturer "site certifications" are prohibited.

1.11 GENERAL ENGINEERING AND DESIGN GUIDELINES

A. Cabling System Installation Practices

1. Plastic cable tie (tie wrap) devices shall *not* be utilized at any time. Only Plenum-rated Velcro-type hook-and-loop strap devices are permitted. In the MDF and IDF rooms, all vertically run cables and conductors shall be secured with Velcro at a maximum interval of eighteen (18) inches, and all horizontally run cables and conductors shall be secured with Velcro at a maximum interval of eighteen (18) inches.
2. In the MDF and IDF rooms, all vertically run innerduct shall be secured with Velcro at a maximum interval of eighteen (18) inch intervals. Innerduct installed on ladder runway shall be supported horizontally and vertically at a maximum of eighteen (18) inch intervals.
3. All horizontally run innerduct shall be secured with Velcro at a maximum interval of forty-eight (48) inches when installed horizontal above accessible ceiling spaces or open ceiling spaces.
4. All cables installed above accessible ceiling spaces shall be independently supported from other systems.
5. A pull rope is to be installed and/or replaced in all below-grade pathways for future use.
6. All intra-building cabling shall be routed either parallel or at right angles to the building structure and/or walls.
7. No cabling shall be pulled through electrical conduit bodies (Condulets) devices. If conduit body devices are pre-existing and it is determined, at the review of the Owner's representative, that sufficient space in the conduit is available and the Owner provides written approval to utilize the Condulet, the Contractor shall remove the Condulet cap, pull the cable to and beyond the cap, then carefully reinstall the cap.
8. Communications cabling shall never be tied or attached to the exterior of electrical conduits, power cables or devices, lighting systems, or co-exist inside any pathway with power or lighting conductors.
9. Any visible damage to a cable such as kinks or bends in violation of the minimum bend radius shall render the cable segment defective and shall be removed and replaced by the Contractor at no additional cost to the Owner.

10. All materials shall be new, unused, and delivered to job site in original manufacturer or distributor cartons or packages. No previously installed material shall be used at any time.
11. Reference Part 3 of this document for additional installation guidelines and requirements.

PART 2 – PRODUCTS

2.1 STRUCTURED CABLING SYSTEM

- A. Acceptable Manufacturers - all equipment listed herein shall be by:
 1. SCS components (faceplates, jacks, patch panels): Panduit, Leviton, or equal.
 2. Copper Category 6A Cable: Superior Essex, Leviton, General, or equal.
 3. Fiber Optic Cable: Corning, OCC, Leviton, or equal.
 4. Fiber Optic Enclosures/Panels: Panduit, Leviton, or equal.
 5. Fiber Optic Connectors: Panduit, Leviton, or equal.
 6. Riser and OSP Copper Cable: Superior Essex, General, or approved equal.
 7. Ladder Runway: Chatsworth, B-Line, or equal.
 8. Equipment Racks, Cabinets: Chatsworth, B-Line, or equal.
 9. Protectors: Circa, Emerson, or approved equal.
- B. It is the responsibility of the bidder to ensure that the proposed product meets or exceeds every standard set forth in these specifications and the equipment's technical data sheets.
- C. The functions and features specified are vital to the operation of this facility; therefore, inclusion of a component's manufacturer in the list of acceptable manufacturers does not release the Contractor from strict compliance with the requirements of this specification.

2.2 OUTLETS

- A. Telecommunications equipment outlets (TO) shall consist of one- or two-gang utility outlet boxes equipped with 8-pin modular (RJ-45) jacks utilizing the T568B wiring scheme and a faceplate. All outlet cabling shall terminate on patch panels at their associated Main Distribution Frame (MDF) room, Intermediate Distribution Frame (IDF) Rooms, or as otherwise indicated on the drawings.
- B. Faceplates

1. All Faceplates shall be available in duplex, quad, or six-plex configuration in a single-gang form factor.
2. Surface mount boxes shall be available in dual, quad, and six-plex configuration.
3. Modular furniture faceplates shall be available in dual and quad configuration for the Owner's modular existing and/or new modular furniture. Faceplates shall be flush-mounted in the modular furniture. Surface mounted boxes/faceplates are unacceptable. The Contractor is responsible for coordinating with the Owner's modular furniture Contractor to determine faceplate requirements. The Contractor shall provide and install all parts/fittings necessary to meet the requirements of this section.
4. Wall mounted phone jack faceplates shall be single gang configuration, constructed of stainless steel and have two standard phone mounting posts located above and below the jack opening. Wall mounted phone faceplates will consist of 8p8c modular (RJ-45) jacks.
5. Faceplates shall have two (2) designation windows, one located at top, and one located at bottom. Designation windows shall be equipped with clear plastic covers to house machine-generated labels.
6. Color of faceplates shall match adjacent electrical plates unless otherwise noted. Contractor shall verify final faceplate color with Owner prior to ordering materials.
7. Provide blank faceplate inserts for all unused outlet locations within the faceplate.

C. Category 6A, 10-Gigabit jacks

1. All category 6A jacks shall be 8-position/8-conductor (8p8c) modular RJ-45 jacks incorporating 110-style rear termination lugs for termination of Category 6A cable, T568B wiring type, with a connector body made of high-impact fire-retardant plastic.
2. Category-6A jacks shall be Channel-rated.
3. All Category 6A jacks shall meet or exceed TIA-568-E.2 component Cat 6A requirements for connecting hardware from 1MHz to 650MHz, 10 GB/s.
4. Category 6A jacks shall include a pair separation tower to facilitate required conductor separation.
5. Category 6A jack color shall be Blue unless otherwise noted on the plan drawings.

2.3 STATION CABLE

- A. Station cables shall extend between the station equipment outlet (TO) and its associated MDF/IDF room.
- B. Category 6A, 10-Gigabit station cable

1. The Category 6A 10-Gigabit cable shall consist of unbonded 4-pair, 23-AWG bare copper twisted pairs with a UTP design.
2. The Cat-6A cable jacket shall be CMP 'plenum' rated with 0.265" overall diameter.
3. Outdoor and underground Cat-6A cable shall be Indoor/Outdoor/Plenum-rated.
4. Category 6A cable shall be ETL verified to TIA-568-E.2-10 Category 6A, and support 10GBASE-T IEEE 802.3an standard of 10 GB/s up to 650MHz.
5. Color of Cat-6A cable shall be Blue unless otherwise noted on the plan drawings.

2.4 MODULAR PATCH PANEL SYSTEM – CATEGORY 6A

- A. The termination block shall support the appropriate emerging high-bandwidth applications, including 1 Gbps Ethernet, potentially 1.2 Gbps ATM and 2.4 Gbps ATM, Multi-Tasked Split Screen Computing, Virtual Holographic Video Conferencing, Instant Access Telemedicine, 3D CAD/CAM Engineering, and Internet-Intranet Communications/ Commerce, as well as all 77 channels (550 MHz) of analog broad band video, including 1000 Mbps Ethernet and potentially 1.2 Gbps ATM, and facilitate cross connection and inter connection using modular patch cords.
- B. All modular patch panels shall have a flat form factor, preloaded with Cat-6A RJ45 connectors, and utilize 110 rear terminations wired to the T568B wiring scheme.
- C. Patch panels shall be 48-port, 2U height (3"), flat, and Black in color.
- D. Contractor shall provide Category 6A modular jack panels in sufficient quantities to terminate all Category 6A cables.
- E. All patch panels shall have two (2) cable strain relief/management bars installed at the rear of the panel to support the terminated horizontal cabling.
- F. Unless otherwise indicated on the bid documents and plan drawings, Contractor shall provide and install a 2RU horizontal wire manager immediately below each 2RU patch panel. A 1RU space shall be left open immediately below the horizontal wire manager before mounting the next patch panel. This space is reserved for installation of a 1RU network switch to service all ports on the patch panel immediately above the horizontal wire manager. Contractor shall verify final required rack equipment layout with Owner prior to cable termination.

2.5 PATCH CORDS / STATION CORDS - CATEGORY 6A

- A. Patch cords shall be equipped with an 8-pin 8-conductor modular connector on each end and shall conform to the length(s) specified. All cords shall be wired to T568B wiring scheme. All cords shall be factory-built by the cable manufacturer. Fabrication of cords in the field is prohibited.
- B. All Category 6A patch cords shall exceed ANSI/TIA/EIA and ISO/IEC Category 6A specifications.

- C. At the MDF and each IDF floor mounted rack/cabinet, provide one (1) 5-foot cat-6A patch cord for each cat-6A cable terminated in the cat-6A patch panels, unless otherwise noted.
- D. At wall-mounted IDF cabinets, provide one (1) 4-foot cat-6A patch cord for each cat-6A cable terminated in the cat-6A patch panels.
- E. At each TO and other devices (waps, cameras, etc.), provide one (1) Cat-6A patch cord for each cat-6A cable terminated at the TO and other devices.
- F. Contractor shall verify all patch cord color and length requirements with Owner prior to ordering material. Include all costs in base bid.
- G. Provide two (2) Category 6A modular patch cords for each cat-6A cable installed on this project.

2.6 FIBER OPTIC CABLING

- A. 12-strand, OS2, 8.3 - 9 micron, single-mode fibers.
- B. Fiber optic cable shall meet or exceed ANSI/EIA/TIA-492 specifications and ISO/IEC 11801 standards.
- C. All fibers shall be color coded to facilitate individual fiber identification per TIA/EIA 569-B.
- D. All fiber optic cable installed inside buildings shall be installed within Contractor-provided innerduct. Innerduct shall be rated for the environment in which it is installed. Innerduct shall be YELLOW in color, unless otherwise noted in the bid documents/plan drawings.
- E. Outdoor-rated and installed cables shall be tight buffered construction.
- F. Cable shall be "indoor-outdoor-plenum-rated" cable.
- G. Provide fiber optic cable when shown on the plan drawings.

2.7 FIBER OPTIC PATCH CORDS

- A. Fiber patch Cords shall be available in duplex single-mode.
- B. Construction shall be either 3.0 mm cordage or 1.6 mm cordage.
- C. Connectors shall be Duplex LC. Verify with Owner prior to ordering materials.
- D. The single-mode fiber optic solution shall utilize factory-made patch cords.
- E. At the MDF and at each IDF room, provide a minimum of one (1) 1-meter LC to LC duplex single-mode fiber optic patch cords for every 6-strands of single-mode fiber installed. Verify patch cord length and connector types with Owner in field prior to ordering product.

2.8 FIBER PATCH PANEL/ENCLOSURE

- A. Fiber Patch Panels/Enclosures: A rack mount or wall mount enclosure that terminates, provides cross connection, interconnection, and splicing and fiber identification up to 72 fiber strands in a 1U form factor. The shelf will provide protection from mechanical stress on the cable and fibers and from macro-bending losses.
1. The shelf shall be wall or rack mountable depending on the location requirement. The units must fit into a 19" wide frame arrangement and have an integrated jumper routing trough.
 2. When wall mounted, the shelf shall consist of a modular enclosure with front and side access and can be fully administered from the front. Wall mount enclosure shall include adjustable fiber management rings, and be constructed of 16-gauge steel, power coated black.
 3. The unit shall have integrated sliding tray to allow bulkhead to glide forward or backward after installation.
 4. The rack mounted enclosure shall have a hinged front cover with door lock included.
 5. Rack mount enclosures shall be available in 1U, 2U and 4U sizes for 19"-wide racks and made of 16-gauge steel power coated black.
 6. The adapter/connector plates shall snap into the front of the enclosure and accommodate LC connectors as required. Adapter plates shall utilize zirconia ceramic sleeves. Single mode adapter plates shall be green in color.
 7. Provide (1) 6-port LC duplex Green colored adapter panel for every 12-strands of single mode fiber optic cable installed.
 8. Fiber patch panel/shelf shall be labeled according to the Owner's specific requirements.
 9. Provide quantity of enclosures and adapter panels as required to terminate all strands.
 10. Provide blank molded plates to cover all unused panel openings.
 11. Include all buffer tube fan out kits as required.

2.9 FIBER OPTIC CONNECTORS

- A. Fiber Optic Connectors: Provide a field installable single mode or multimode type connectors to terminate fiber optic cables from cable-to-cable, cable-to-equipment, or equipment-to-equipment, and to make jumpers.
1. The connector must:

- a. Be pre-polished and field installable.
- b. Ferrule shall be made of zirconia ceramic.
- c. Be capable of mounting on either 250 um or 900 um buffered fiber.
- d. Single mode shall be rated OS2.
- e. Average connector insertion loss: Single mode 0.3dB.
- f. Maximum insertion loss: Single-mode 0.5dB.
- g. Be available in LC style, Blue color for single-mode.
- h. Have a locking feature to the coupler and assure non-optical disconnect.

2.10 COPPER CABLING

A. Outside Plant Multipair Copper Cables

- 1. All outside plant multipair copper cables shall support analog voice circuits (fire alarm, intrusion alarm, elevator phone, etcetera) and building energy management systems.
- 2. All copper cable placed in the outside environment shall be 24 AWG, solid annealed copper, twisted pair, and multi-conductor. Refer to section 1.12.A of this document for additional requirements.
- 3. Quantity of twisted pairs shall be 25 pairs.
- 4. The outside plant cable shall have PET Tape core wrap.
- 5. The outside plant cable shall have a low smoke zero halogen, Indoor/Outdoor grade jacket.
- 6. All outside plant cable shall be installed in conduit. Direct burying of cable is prohibited.
- 7. Multi-pair voice grade copper cables installed in underground conduit shall be minimum Category-5E rated.
- 8. Provide outside plant cabling when shown on the plan drawings.

- B. Indoor Multipair Copper (Riser) Cables:** In multi-story buildings, shielded or unshielded 24 AWG multi-pair copper cables shall be used as vertical riser cables between floors. The inner-building cable shall support analog voice circuits (fire alarm, intrusion alarm, elevator phone, etc.) and building energy management systems. The bending radius and pulling strength requirements of all backbone cables shall be observed during handling and installation. The multi-pair copper cables shall be in plenum or riser rated form and placed in conduit as required by code, or as noted on the bid documents/plan drawings.

1. Shielded: The shielded cable, 25 pair or more, shall consist of solid-copper conductors insulated with expanded polyethylene covered by a PVC skin, be conformance tested to meet ANSI/TIA/EIA 568-C for Category 5E cables, be UL and Listed as CMR. The core shall be overlaid with a corrugated aluminum sheath, which is adhesively bonded to an outer jacket of PVC plastic to form an ALVYN sheath.
 - a. The cable shall be available in 25, 50, 100 through 1800 pair counts.
2. Non-shielded: The non-shielded non-plenum cable shall consist of 24-AWG solid-copper conductors insulated with color coded PVC, UL Verified to ANSI/TIA/EIA 568-C for Category 5E. The non-shielded cable shall be available in 25, 50, 75 and 100 pair.

2.11 INDOOR MULTI-PAIR RISER CABLE TERMINATIONS

- A. The multipair riser cable wiring block shall be 66M-split-type and support Category 5E and 6 applications and facilitate cross connection and interconnection using either cross connect wire or the appropriate category patch cords. The wiring blocks shall support analog voice circuits (fire alarm, intrusion alarm, elevator phone, etc.) and building energy management circuits.
 1. The wiring blocks shall be fire retardant, molded plastic 4 columns of metal contacts. The blocks will have 100 contacts which are divided into 50 pairs. This will allow the termination of 25 individual cable pairs on the left and right side of the wiring block, for a total of 50 cable pairs per block.
 2. The wiring blocks shall have a series of fanning strips shall be located on each side of the block for dressing the cable pairs terminated on the adjacent contacts.
 3. Plastic hinged covers shall be provided on each block and shall not interfere with running, tracing, or removing jumper wire. Labels shall be color-coded, and machine labeled/numbered according to Owner's requirements.
 4. The wiring blocks shall be able to mount directly on wall surfaces utilizing a standoff bracket, either with or without metal backboards. The standoff bracket shall be 10" high by 3.40" wide by 1.50" deep.
 5. The wiring blocks shall be able to accommodate over 500 repeated insertions without incurring permanent deformation and it shall pass the reliability test of no more than one contact failure in 10,000 connections.
- B. MPOE/MDF/IDF Rooms, or as otherwise indicated on drawings, shall be equipped with 66M-type termination blocks for termination of analog station cables. All blocks shall be securely fastened to the room backboards or equipment racks – refer to bid documents/plan drawings. Provide all required D-rings or other approved cable guides as required to provide a neat installation. All cables shall terminate in numerical sequence. Refer to subsection above for description of termination blocks.

2.12 PROTECTORS

- A. All outside plant underground backbone multi-pair copper cables shall be provided with transient voltage protection between each building with a building entrance-cable protector panel(s). All building-to-building multipair copper cables shall be routed through this protector(s). The protector(s) shall be connected with a #6 AWG copper bonding conductor between the protector's ground lug and the MDF/IDF telecommunications ground busbar (TMGB/TBG).
- B. Plug in Surge Protection Modules shall be provided for each pair terminated on the protector chassis. Protector module shall be solid-state type unless otherwise noted.
 - 1. 240VDC/300VDC solid-state protector modules shall provide transient and power fault protection for standard telephone line applications. The modules shall be fast acting, self-resetting current limiters to protect against sneak current type faults. These modules shall be UL Listed with integrated test points and Black in color.
 - 2. 30VDC/75VDC solid-state protector modules shall provide transient and power fault protection for digital and data line applications. The modules shall be fast acting, self-resetting current limiters to protect against sneak current type faults. These modules shall be UL Listed with integrated test points and Red in color.
 - 3. In the event that protector modules are not called out in the drawings, Contractor shall include all costs in base bid to provide the 75v solid-state modules w/sneak current protection. Confirm module color with Owner's Engineer prior to ordering. In all cases, the Contractor is responsible to coordinate appropriate module with Owner prior to ordering material.
- C. Product Specification: Circa, Emerson or Marconi.

2.13 GROUNDING SYSTEM AND CONDUCTORS

- A. The Contractor shall utilize a Telecommunications Bonding Backbone (TBB) as provided by the Electrical Contractor. The Contractor shall terminate TBB cable(s) on Contractor-provided ground bus bars located at each MDF/IDF Room, or as otherwise indicated on the drawings. Ground bus bars shall be ANSI-J-STD-607-E compliant, and UL Listed. MDF telecom main ground bus bar (TMGB) shall be Chatsworth #40153-020. IDF telecom ground bus bars (TGB) shall be Chatsworth #40153-012, or as noted on the drawings. Wall mounted cabinets require a horizontal rack bus bar (Chatsworth #10610-XXX) (equal by Harger). All communication system bonding and grounding shall be in accordance with the ANSI-J-STD-607-A (current edition), the NEC/CEC, and NFPA.
- B. Horizontal cables shall be grounded in compliance with ANSI/NFPA 70 and local requirements and practices.
- C. Horizontal equipment including cross connect frames, patch panels, cable trays, equipment racks, ladder trays, conduits, active telecommunication equipment, test apparatus and equipment shall be bonded to the ground bus bars utilizing a #6-AWG solid copper green insulated conductor and 2-hole crimp type grounding lugs. All connections shall be bare metal to bare metal using appropriate antioxidant compound. Burndy mechanical-type grounding lugs and terminals are prohibited.

Minimize the length and number of bends of the grounding conductors to the busbar. Attachment to every rack and cabinet shall be made by one of the following methods:

1. Wall mounted IDF cabinets- Attach ground conductor's 2-hole compression lug to the rear rail's bottom holes of the rack, using either two (2) tri-lobular thread-forming screws (not self-tapping or sheet metal screws) or by using two (2) standard bolts with two (2) "Type B" internal-external tooth lock washers per bolt. If thread-forming screws are not used, remove paint at the connection point and use an approved anti-oxidant prior to attaching the ground conductor.
 2. Floor Mounted Cabinet/Racks - Install a dedicated copper horizontal ground busbar strip at the top of the rear rail of each rack and cabinet. Attach ground conductor's 2-hole compression lug to this ground strip using either tri-lobular thread-forming screws (not self-tapping or sheet metal screws) or by using two (2) standard bolts with two (2) "Type B" internal-external tooth lock washers per bolt.
- D. The Contractor shall be responsible for providing an approved ground at all newly installed distribution frames, and/or insuring proper bonding to any existing facilities. The Contractor shall also be responsible for ensuring ground continuity by properly bonding all appropriate cabling, cable sheaths, circuit protectors, closures, cabinets, service boxes, and framework.
- E. Contractor shall label both ends of each grounding conductor as close as practical to the point of termination in a readable position. Ground tag must indicate the location of both ends of the ground conductor (e.g., Rack#1 to TMGB) and tag must include the warning "If this connector or cable is loose or must be removed, please call the Owner's Telecommunications Manager at xxx-xxx-xxxx (Contractor shall include the proper phone number on this label)".

2.14 OPEN EQUIPMENT RACKS

- A. When shown on drawings, communication closets shall be equipped with floor mounted, open equipment racks provided by the Contractor to house shelves, patch panels, power strips, LAN electronics, UPS, etcetera. The racks shall be made of aluminum and include mounting hardware for mounting specified termination equipment to the frame.
- B. Open 2-post rack dimensions shall be 7' H x 19" W x 3" D.
- C. Racks shall be UL-Listed, and rated for heavy-duty, high-capacity installations. The 2-post racks shall be rated up to 1500 pounds, and 4-post racks rated to 2000 pounds.
- D. Equipment racks and rack mount accessories shall be Black in color.
- E. Floor mounted open racks shall be secured from the base to the structural floor to prevent movement and secured to ladder tray sections installed above. Contractor shall provide and install a minimum of four (4) fasteners/anchors per floor mounted rack. Fasteners installed to the structural floor shall be torqued to the "fastener manufacturer's" recommendation.

- F. Racks mounted on raised floors shall be seismically braced to the structural floor below the raised floor to the satisfaction of DSA, and all local, state, and federal requirements.
- G. Floor-mounted open racks shall be secured to the overhead ladder runway.
- H. All racks shall be individually grounded to the dedicated telecommunications ground busbar (TMGB, TGB) within the equipment room. Refer to grounding section 2.13 of this document. "Daisy-chaining" a ground conductor between racks or to other components is not allowed.
- I. All racks shall be equipped with vertical cable managers on each side, and horizontal cable managers. Refer to cable manager section in this document for more information.
- J. Refer to plan drawings for quantity and locations of all open equipment racks.
- K. Product Specification: B-Line 2-post rack #SB556084XU, or Chatsworth, 2-post rack #48353-703, 4-post rack #15218-703

2.15 EQUIPMENT CABINETS

- A. When shown on drawings, cabinets shall be provided by the Contractor to house shelves, patch panels, power strips, LAN electronics, UPS, etcetera. The cabinets shall be UL Listed and include mounting hardware for mounting specified termination equipment to the frame. In addition, the mounting hardware must provide vertical and horizontal wire managers for patch cords and equipment cords.
- B. Wall mount cabinet dimensions shall be 24"H x 24"W x 30"D, 36"H x 24"W x 30"D, and 48" H x 24" W x 30" D. Refer to plan drawings for specific quantity and sizes required.
- C. Wall mount Low Profile cabinets shall be 42"H x 24"W x 10"D.
- D. Contractor shall provide vertical and horizontal wire managers for patch and equipment cords.
- E. Cabinets and accessories shall be Black in color. Low profile cabinets shall be Gray in color.
- F. Wall mounted cabinets, when indicated on the plan drawings, shall be secured to plywood backboard at locations indicated on the plan drawings. Contractor shall provide and install fasteners and anchors that are designed and rated for the determined mounting surface and building construction type. Contractor shall provide and install fasteners and anchors that are designed and rated for the combined weight of the equipment support cabinet and its contents. Contractor shall be responsible for determining correct cabinet mounting and anchoring methods that will safely support the combined weight of the cabinet and its contents. Contractor shall install cabinet in such a manner that a minimum of four (4) fasteners and/or anchors are attached directly into wall framing studs, or if applicable, masonry or concrete

wall. Anchoring methods shall comply with DSA requirements and all local, state, and federal safety codes.

- G. Cabinets shall be configured per the Owner's Project Manager's direction.
- H. All floor and wall mounted cabinets shall be individually grounded to the isolated ground busbar (TMGB, TGB) within the equipment room per section 2.13 of this document. Daisy chaining of ground wire between cabinets or to other components is not allowed. Wall mounted Low Profile Cabinets shall be grounded to the nearest electrical panel's ground busbar using a 2-hole compression lug and #6 jacketed green cable.
- I. Cabinets mounted on raised floors shall be seismically braced to the structural floor below the raised floor to the satisfaction of DSA and all local, state, and federal requirements.
- J. Cabinets shall come equipped with a locking Plexiglas front door.
- K. Product Specification: Chatsworth Cube-IT #12419-724, #12419-736, #12419-748, Hubbell Low Profile #RE4X

2.16 HORIZONTAL AND VERTICAL CABLE MANAGERS

- A. Horizontal cable managers shall be available in 1RU and 2RU sizes and fit in 19"-wide racks and cabinets. Horizontal managers shall be single-sided unless otherwise noted. Manager shall be a flat for factor and have 5 rings.
- B. Vertical managers shall be 7-foot high, 6-inch wide, double sided, with full length hinged door on the front and open cable rings on the rear. Provide 10-inch wide instead of 6-inch-wide vertical managers when specifically noted on the plan drawings.
- C. In each MDF and IDF rack, provide one (1) 1RU horizontal cable manager below each rack mounted fiber enclosure, and below each 24-port patch panel, unless otherwise noted. Provide one (1) 2RU horizontal cable manager below each 48-port patch panel, unless otherwise noted.
- D. Product Specification: Chatsworth Vertical Manager #40095-703, Chatsworth 1RU horizontal manager #30139-719, Leviton 1RU horizontal manager #49253-6PM, Leviton 2RU horizontal manager #49253-2CM.

2.17 BACKBOARDS

- A. Where indicated on plan drawings, provide new plywood terminal backboards. Use Douglas Fir plywood, A/C grade, finished A-side facing out, with prime coat painted on all surfaces (front, back and sides), and two (2) finished coats of white enamel paint on the front. On each plywood sheet leave one (1) Fire Marshal Stamp unpainted for inspection. Unless otherwise indicated, use 8'-0" high x 3/4" thick plywood x length as shown on the plan drawings.

2.18 UNSPECIFIED EQUIPMENT AND MATERIAL

- A. Any item of equipment or material not specifically addressed on the drawings or in this document and required to provide a complete and functional SCS installation shall be provided in a level of quality consistent with other specified items.

2.19 FIRE RATED PATHWAY

- A. The firewall through-penetration shall be a manufactured, UL Classified, firestop device/ system designed to allow cables to penetrate fire-rated walls with a built-in fire sealing system that automatically adjusts to the amount of cables installed.
- B. The firestopping device shall be capable of installation in new construction or retrofit in existing structures.
- C. The device shall be UL Tested and Classified in accordance with ASTM E814 (UL 1479) and with ratings up to and including 2 hours.
- D. Contractor shall be responsible to provide firestopping devices for all SCS cables that penetrate a fire-rated assembly (wall, floor, ceiling).
- E. Manufacturer: Specified Technologies Inc., EZ-Path (#EZDP33FW) or equal by Wiremold.

PART 3 – EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. The wiring of the system shall be executed in accordance with the drawings and the equipment manufacturer's wiring diagrams. Should any variations in these requirements occur, the Contractor shall notify the Owner's Project Manager before making any changes. It shall be the responsibility of the manufacturer-authorized distributor of the approved equipment to install the equipment and guarantee the system to operate as per plans and specifications.
- B. Furnish all conductors, equipment plugs, terminal strips, etcetera, and labor to install a complete and operable system.
- C. The cables within the rack or cabinets shall be numbered for identification using machine generated labels wrapped around the cable jacket within 6 inches of termination point. Refer to Labeling Requirements section of this document for additional requirements. Handwritten labels are prohibited.
- D. Splicing of any cable is prohibited unless specifically noted on the plan drawings.
- E. The labor employed by the Contractor shall be regularly employed in the installation and repair of communication systems and shall be acceptable to the Owner's Project Manager to engage in the installation and service of this system.
- F. The system must meet all local and other prevailing codes.
- G. All cabling installations shall be performed by qualified and manufacturer-trained technicians.

- H. Cable lubricants (e.g., Polywater) shall be used to reduce the cable pull tension stated by the cable manufacturer during cable installation in conduits and innerduct. SCS Contractor shall verify the acceptability of the lubricant to be used with the cable manufacturer, prior to using such a lubricant. Lubricants that harden after installation are not allowed. Submit all proposed lubricants for approval PRIOR to use on low voltage, A/V, coax, fiber, and data cable installation. Cable lubricants shall be allowed to dry a minimum of 15 days before performing cable certification tests.
- I. Indoor rated cables may be run exposed above accessible ceilings, provided the cabling is supported independent of other utilities such as conduits, pipes, and the ceiling support systems. The Contractor shall include all costs in base bid for any additional supports/seismic bracing required by the Local Authority having Jurisdiction. The cables shall not be laid directly on the ceiling panels.
- J. The cable jacket composition must meet local and all other prevailing fire and safety codes.
- K. All firewalls penetrated by structured cabling shall be sealed by use of a non-permanent fire blanket or other method in compliance with the current edition of NFPA and the CEC or other prevailing code and must be a system listed by UL. The SCS Contractor must not use concrete or other non-removable substance for fire stopping on cable trays, wireways or conduits. Contractors who use this method will be required to replace all cables affected and provide the original specified access to each effected area. This requirement also applies to maintaining fire ratings of all floors penetrated by conduits or devices designated for use by voice and data cabling.
- L. All equipment racks and cabinets shall be bolted to the structural floor by the SCS Contractor in the location shown on drawings. Wall mounted relay rack and wall mounted cabinet kits shall be fastened to structural studs, not drywall or backboard only.
- M. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor before final acceptance at no cost to the Owner.
- N. The cable manufacturer's minimum bend radius and maximum pulling tension shall not be exceeded.
- O. Cable raceways, when required, shall not be filled greater than the NEC maximum fill for the particular raceway type. At no point shall any conduit fill exceed 40 percent.
- P. SCS Contractor shall provide and install all conduit sleeve penetrations through all sound and fire rated assemblies (wall, floor, ceiling) whether or not the sleeves are shown on the plan drawings. Include all costs in base bid. All low voltage cables that penetrate a wall, floor or ceiling shall be enclosed in a conduit sleeve. Penetrations through fire-rated assemblies shall be properly fire stopped to the original fire rating of the assembly by the Contractor.
- Q. Roof penetrations are prohibited, unless specifically noted on the plan drawings. No conduit shall be installed on roofs or route horizontally on exterior walls.

3.2 SPECIFIC SYSTEM INSTALLATION REQUIREMENTS

- A. All cabling used throughout this project shall comply with the requirements as outlined in the NEC Articles 725, 760, 770, and 800 (or related CEC Articles), and the appropriate local codes. All copper cabling shall bear UL listed type CMP (Plenum Rated). All fiber optic cabling shall be Indoor/Outdoor/Plenum rated.
- B. All warranties begin when an Acceptance of Work Product (AWP) is signed by the Owner.
- C. Contractor shall perform, at its own cost and expense and without reimbursement from the Owner, any work necessary to correct errors or omissions which are identified by the Owner and communicated in writing.
- D. All projects are complete turn-key and the responsibility of the Contractor until an AWP is signed by the Owner. The Contractor shall be responsible for bring product(s) to site, placing, installing, securing, and configuring Contractor provided equipment at no additional charge.
- E. Owner by written notice to Contractor may in its sole discretion suspend or terminate any or all activities, in whole or part, under the Contract or purchase order, at any time, when in the best interest of the Owner to do so.
- F. Service Loops – Contractor shall provide cable service loops (slack loops) as follows: 10-foot service loop for all cables in the MDF and IDF; 3-foot service loop for all end point or equipment outlets. MDF and IDF room service loops may be located on the backboard or ladder rack system if dressed and secured in a neat, workmanlike fashion. End point/equipment outlet service loops shall be neatly installed and secured above accessible ceiling.
- G. Cable Pathways:
 - 1. In suspended ceilings and accessible ceiling areas where duct, cable trays or conduit are not available, the Contractor shall bundle cable, in bundles of 48 or less. Cable bundles shall be supported via "J" hooks attached to the existing building structure and framework at a maximum of five (5) foot intervals. The SCS Contractor shall adhere to the manufacturers' requirements for bending radius and pulling tension of all cables.
 - 2. Cables or J-hooks shall not be attached to lift-out ceiling grid supports or laid directly on the ceiling grid.
 - 3. Cables or J-hooks shall not be attached to or supported by fire sprinkler heads, HVAC ducts, or delivery systems, or any environmental sensor located in the ceiling air space.
 - 4. Where additional conduit(s)/sleeve(s) are required, but not provided by the electrical Contractor, the cabling Contractor shall be responsible to provide such conduit(s)/sleeve(s). Conduit(s) and sleeve(s) shall be of suitable material, sized, installed, fire-stopped, and grounded as may be required by the NEC, ANSI/TIA/EIA standards and all other applicable codes and standards. Any

conduit(s) and sleeve(s) added by the Contractor shall be approved by the Owner's Project Manager prior to rough-in. Conduit sleeves 10 feet in length or less do not require grounding.

5. All J-hooks shall be rated and designed for Category 6A cabling.
 6. Contractor shall provide and install labeling of all conduit pathways on both ends.
- H. Sealing of openings between floors, into or through rated fire and smoke walls, existing or created by the Contractor for placement of new or removal of old cable into or through shall be the responsibility of the SCS Contractor. Sealing material (Approved UL listed system) and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the Contractor's work. Any openings created by or for the SCS Contractor and left unused shall also be sealed as part of this work.
1. Fire stopping work shall be performed by a single Contractor to maintain consistency and accountability on the project.
 2. The Contractor shall install penetration firestop seal materials in accordance with design requirements, and manufacturer's instructions.
 3. The Contractor's installer shall be certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements.
 4. All installed through penetration firestops shall be identified via label, or stencil. Label shall state that the fill material around the penetrating item is a firestop, and that it shall not be disturbed unless by an authorized Contractor. The label shall include the firestop brand name, and the classified system number for which it was installed.
 - a. Sample Label:
MANUFACTURER'S NAME:
ATTENTION
Fire Rated Assembly
For Any Changes To This System, Please Refer To UL System Listed Below
PRODUCT:
HOUR RATING:
UL SYSTEM:
INSTALLATION DATE:
INSTALLED BY: (Contractor's Company name)
CONTRACTOR LICENSE NUMBER:
BUSINESS PHONE:
EMAIL ADDRESS:

- I. The Contractor shall be responsible for damage to any surfaces or work disrupted because of his work. Repair of surfaces, including painting, shall be included as necessary.
- J. Cable bundles within the MDF/IDF shall be dressed into bundles of no more than twenty-four (24) cables.
- K. The Contractor shall install all patch cords per direction of the Owner's project manager in a neat and systematic fashion. Patch cord color shall match the terminated cable and jack unless otherwise noted by the Owner. Prior to installing all patch cords, the Contractor shall install patch cords in a single rack to demonstrate work practices to the Owner's project manager. Only after any corrections/modification to the installation as directed by the Owner's project manager, may the Contractor continue installing the patch cords in the remaining racks.
- L. Rack/cabinet-mounted electronic equipment shall be grounded via the equipment chassis, in accordance with manufacturer's instructions. The equipment chassis shall be bonded to the rack/cabinet using one of the following methods:
 - 1. If the equipment has a separate grounding hole or stud, use a #10-AWG ground wire from the chassis ground hole/stud to the rack grounding bus.
 - 2. If the manufacturer suggests grounding via the chassis mounting flanges, use tri-lobular thread-forming screws (not self-tapping or sheet metal screws) to attach the equipment to the rack/cabinet rails. If the equipment mounting flanges are painted, remove the paint and apply an anti-oxidant, or use tri-lobular thread-forming screws and two (2) "Type B" internal-external tooth lock washers to safely ground equipment to the rack.
- M. Bonding of ladder tray sections- Attach bonding straps to each ladder tray section by utilizing either two (2) tri-lobular thread-forming screws (not self-tapping or sheet metal screws) or by using two (2) standard bolts with two (2) "Type B" internal-external tooth lock washers per bolt. If thread-forming screws are not used, remove paint at each connection point and use an approved anti-oxidant prior to attaching the bonding strap.
- N. All installation shall be done in conformance with TIA/EIA 568-E standards, BICSI TDMM guidelines and manufacturer's installation guidelines. The Contractor shall ensure that the maximum pulling tensions of the specified distribution cables are not exceeded and cable bends maintain the proper radius during the placement of the facilities. Failure to follow the appropriate guidelines will require the Contractor to provide, in a timely fashion, any additional material and labor necessary to properly rectify the situation to the satisfaction and written approval of the Owner's Project Manager. This shall also apply to all damages sustained to the cables by the Contractor during the implementation.
 - 1. Bonding and Grounding: All cable sheaths and splice cases shall be grounded to a Telecommunications Ground Bus. All grounding must be in accordance with the NEC, CEC, NFPA, ANSI-J-STD-607-E and all local codes and practices. The Electrical Contractor shall be responsible for providing a properly sized grounding

conductor from the main electrical ground to the telecommunications ground bus in each MDF/IDF room. The SCS Contractor shall be responsible to provide the telecommunications busbar (TMGB, TGB), attach the Electrical Contractor-provided ground conductor, and bond all required equipment and components within each MDF/IDF to the busbar.

2. **Power Separation:** The Contractor shall not place any distribution cabling alongside power lines, or share the same conduit, channel, or sleeve with electrical apparatus. Maintain a minimum of 12-inch separation from light fixtures. Equipment racks and cabinets shall maintain a minimum of 48-inch separation from electrical transformers.
3. **Miscellaneous Equipment:** The Contractor shall provide any necessary screws, anchors, clamps, hook & loop ties, distribution rings, wire molding (MDF & IDF locations), miscellaneous grounding and support hardware, etcetera, necessary to facilitate the installation of the System.
4. **Special Equipment and Tools:** It shall be the responsibility of the Contractor to furnish any special installation equipment or tools necessary to properly complete the System. This may include, but is not limited to, tools for terminating cables, testing, and splicing equipment for copper/fiber cables, communication devices, jack stands for cable reels, or cable winches.
5. **Labeling:** The Contractor shall be responsible for printed labels for all pull boxes, conduits, cables, protectors, racks, cabinets, patch panels, connector panels, cords, distribution frames, and outlet locations, according to the specifications. Handwritten labels are prohibited. See LABELING REQUIREMENTS Section 3.9 of this document for more information.
6. **Cable Storage:** The Contractor shall not roll or store cable reels without an appropriate underlay and the prior written approval of Owner's Project Manager.
7. **Cable Records:** The Contractor shall maintain conductor polarity (tip and ring) identification at the main equipment room (switch room), risers, and station connecting blocks in accordance with industry practices, but only in locations authorized by the Owner's Project Manager. Contractor to provide spread sheet for all outdoor backbone and indoor riser backbone cables tested.

3.3 STRUCTURED CABLING GENERAL INSTALLATION DESCRIPTION

A. The structured cabling system shall consist of the following subsystems:

1. Work Area Subsystem
2. Horizontal Subsystem
3. Administration Subsystem
4. Backbone Subsystem
5. Equipment Subsystem

- B. Work Area Subsystem: The Work Area Subsystem provides the connection between the telecommunications outlet (TO) and the station equipment in the work area. It consists of patch cords, adapters, and other transmission electronics.
 - 1. Contractor shall supply the wiring or patch cords that connect terminal devices to telecommunications outlets. This includes mounting cords and connectors.
- C. Horizontal Subsystem: The Horizontal Subsystem provides connections from the horizontal cross connect to the telecommunications outlets in the work areas. It consists of the horizontal transmission media (copper, fiber, etc.), the associated connecting hardware terminating this media and outlets in the work area. Each floor of a building is served by its own Horizontal Subsystem(s) unless otherwise noted on the plan drawings.
 - 1. Horizontal Cabling
 - a. Contractor shall supply horizontal cables to connect each telecommunications outlet to the backbone subsystem as shown on the drawings.
 - b. Unless otherwise noted on the floor plans or within this document, the type of horizontal cables used for each work location shall be 4-pair unshielded twisted pair (UTP).
 - c. The 4-pair UTP cables shall be run using a star topology format from the administration subsystem to every individual telecommunications outlet. All cable routes, other than those dictated on the drawings, are to be approved by Owner's Project Manager prior to installation.
 - d. The length of each individual run of horizontal cable from the administration subsystem to the telecommunications outlet shall not exceed 295-ft (90 m).
 - e. Contractor shall observe the bending radius and pulling strength requirements of the 4-pair UTP cable during handling and installation.
 - f. Each run of cable between the termination block and the telecommunications outlet shall be continuous without any joints or splices.
 - g. All station cable shall be placed in the interior of walls unless otherwise noted in the bid documents/plan drawings.
 - h. In the event Contractor is required to remove ceiling tiles, such Work shall not break or disturb the ceiling grid. Removal of the ceiling grid must be coordinated with the Owner's Project Manager. All insulation shall be replaced in its original location. Contractor shall be responsible to replace any ceiling tiles that they damage during the course of their work, at no additional cost to the Owner.
 - i. Avoid electromagnetic interference (EMI) by maintaining adequate physical separation between telecommunications cabling and possible sources such as, but not limited to, electric motors, electric erasers, electric pencil

sharpeners, transformers, fluorescent lighting that share distribution space with telecommunications cabling, copiers that share work area space with line cords and terminals, large fax machines and power cords that supports such equipment. Minimum separation shall be six (6) inches.

- j. Contractor shall provide Owner's Project Manager with detailed cable run diagrams for cable runs within raised floors (if shown on plans) detailing exact locations of cable for review and written approval by Owner's Project Manager.
 - k. Conduit runs installed above grade by the Contractor should not exceed 100 feet or contain more than two 90 degree bends without utilizing appropriately sized pull box. Pull boxes are not to be used in lieu of a bend.
 - l. Station cables and riser cables installed within ceiling spaces shall be routed through these spaces at right angles to electrical power circuits.
 - m. Cable service slack loop shall be located within 15' of the MDF/IDF rack/cabinet as required to maintain a neat and "workmanship like" installation.
- D. Administration Subsystem: The Administration Subsystem links all the subsystems together. It consists of labeling hardware for providing circuit identification and patch cords or jumper wire used for creating circuit connections at the cross connects. All wall field layouts must be approved by Owner's Project Manager prior to rough-in and installation.
- 1. Separate termination fields shall be created for voice/data, wireless access points, paging, surveillance cameras, clocks, and building energy management system applications.
 - 2. Termination blocks that require rotation after connection of horizontal/vertical wiring will not be allowed.
 - 3. Contractor shall supply cross-connect wire, patch cords and fiber patch cords for cross-connection and inter-connection of termination blocks and lightguide interconnection units.
- E. Backbone Subsystem:
- 1. The main cable route between two or more buildings is called the Backbone Subsystem. It links the main distribution frame (MDF) in the equipment room to each intermediate distribution frame (IDF). It consists of the backbone transmission media between these locations and the associated connecting hardware terminating this media. It is normally installed in a star topology, with first-level backbone cables beginning at the main cross connect. If needed, second-level backbone cables begin at intermediate cross connects.
 - 2. The backbone subsystem shall include vertical runs (riser) of in-building cable between floors of a multi-story building, if applicable.

3. All backbone fiber optic cable(s) will be run in innerduct and terminated in the MDF/IDF Rooms, or as otherwise indicated on the plan drawings, with connectors, type as specified elsewhere, in rack mounted or wall mounted fiber patch panels equipped with sufficient panels, couplers and jumper storage shelves to terminate and secure all fibers. All innerduct (Carlson or equal) shall be corrugated and a minimum of 3/4" in diameter unless otherwise indicated on plans. Innerduct shall be plenum, riser or general rated as required by the environment in which it is to be installed. Innerduct capacity shall not exceed 40 percent fill.
 4. All backbone multipair copper cable(s) will be terminated in the MDF/MPOE/IDF rooms, or as otherwise indicated on the plan drawings. Backbone multipair cable shall be terminated on building entrance fused protectors as specified elsewhere in this document. The minimum pair count for multipair copper cable between buildings shall be 25-pairs. Refer to bid documents/plan drawings for any additional required pairs.
 5. In multi-story buildings, Contractor shall supply multi-pair copper cables and optical cables as the riser cables between floors. Reference this document and plan drawings for quantities. Contractor shall observe the bending radius and pulling strength requirements of all backbone cables during handling and installation.
- F. Equipment Room Subsystem: The Equipment Subsystem consists of shared (common) electronic communications equipment in the equipment room or telecommunications closet and the transmission media required to terminate this equipment on distribution hardware.

3.4 DAMAGES

- A. The Contractor will be held responsible for all damages to portions of the building caused by it, its employees, or sub-Contractors; including but not limited to:
1. Damage to any portion of the building caused by the movement of tools, materials, or equipment.
 2. Damage to any component of the construction of spaces.
 3. Damage to the electrical distribution system.
 4. Damage to the electrical, mechanical and/or life safety or other systems caused by inappropriate operation or connections made by the Contractor or other actions of Contractor.
 5. Damage to the materials, tools and/or equipment of the Owner, its consultants, agents, and tenants.

3.5 PENETRATIONS OF WALLS FLOORS AND CEILINGS

- A. Unless specifically shown on the drawings, the Contractor shall make no penetration of floors, walls, or ceiling without the prior written approval of the Owner's Project Manager.
- B. Any penetrations through acoustical walls or other walls for cable pathways/cables shall be sealed by the Contractor in compliance with applicable code requirements and as directed by Owner's Project Manager.
- C. Any penetrations through fire-rated walls for cable pathways/cables shall be sealed by the Contractor as required by code and as directed by Owner's Project Manager. The Contractor shall be required to work together with the General Contractor and the Electrical Contractor to coordinate and develop all fire stopping methods prior to any cable installation. The Contractor shall also, prior to the commencement of on-site activities, submit to Owner's Project Manager, details of any special systems to be used.
- D. Roof penetrations are prohibited. No conduit shall be installed on roofs or route horizontally on exterior walls.

3.6 TESTING AND WARRANTY

- A. Structured Cabling System
 - 1. The Contractor shall provide competent, test equipment manufacturer-trained engineers and/or technicians, authorized by the manufacturer of the cabling system, to technically supervise and participate during all tests for the systems.
 - 2. All cables and termination hardware shall be 100% tested for defects in installation and to verify cable performance under installed conditions. All conductors of each installed cable shall be verified usable by the Contractor before system acceptance. Any defect in the cable system installation including but not limited to cable, connectors, feed-through couplers, patch panels, splices, and connector blocks shall be repaired or replaced to ensure 100% useable conductors in all cables installed.
 - 3. Each cable shall be tested for continuity on all pairs and/or conductors. Twisted-pair voice cables shall be tested for length, continuity, pair reversals, opens, shorts, transpositions, presence of AC and DC voltages and opens. Twisted-pair horizontal cables shall be tested per the above requirements, plus tests that indicate installed cable performance. Category-6A cables shall be tested using a TIA-568-E.2-1 Category 6A Level III/IEC 61935 Level III or better, ETL certified cable tester/analyzer.
 - 4. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests.
 - 5. The test shall be recorded as pass/fail as indicated by the test set in accordance with the manufacturers recommended procedures and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested before final acceptance.

6. Each installed cable shall be tested for installed length using a Time Domain Reflectometer (TDR) type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the TIA-568-E Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number.
7. Multi-pair cables, record the following tests on every cable pair in each multipair cable using a TDR type device: record the shortest pair length, continuity, pair reversals, shorts, opens, transpositions, presence of AC and DC voltage.
8. Category 6A data cable shall be performance verified using an automated test set. This test set shall be capable of testing for the continuity and length parameters defined above, and provide results for the following tests:
 - a. Attenuation (Insertion Loss).
 - b. Return Loss (RL).
 - c. Near End Crosstalk (NEXT) – measured at both ends of each cable pair.
 - d. Attenuation to Crosstalk Ratio (ACR).
 - e. Power Sum Near End Crosstalk (PSNEXT).
 - f. Power Sum Attenuation to Crosstalk Ratio (PSACR).
 - g. Far End Crosstalk (FEXT).
 - h. Equal Level Far End Crosstalk (ELFEXT).
 - i. Power Sum Equal Level Far End Crosstalk (PSELFEXT).
9. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the ANSI/TIA/EIA Standard, and the result shown as pass/fail. Test results shall be printed directly from the test unit or from a download file using an application from the test equipment manufacturer. The printed test results shall include all tests performed, the expected test result, and the actual test result achieved.
10. Optical Fiber Cable Testing: All fiber testing shall be performed on all fibers in the completed end to end system by test equipment manufacturer-trained engineers and/or technicians. There shall be no splices unless clearly defined in Section 3 of this specification or on the plan drawings. Testing shall consist of a bi-directional end to end OTDR trace performed per ANSI/TIA/EIA 455-61 & ANSI/TIA/EIA 526 and a bi-directional end to end power meter test performed per ANSI/TIA/EIA 455-53A. The system loss measurements shall be provided at 850 and 1300 nanometers for multimode fibers and 1310 and 1550 for single mode fibers.

- a. Pre-installation cable testing: The Contractor shall test all fiber optic cable prior to the installation of the cable. The Contractor shall assume all liability for the replacement of the cable should it be found defective during the warranty period.
 - b. Loss Budget: Fiber links shall have a maximum loss of: (allowable cable loss per km) x (km of fiber in link) + (.4dB) x (number of connectors) = maximum allowable loss.
 - c. Any link not meeting the requirements of the standard shall be brought into compliance by the Contractor, at no additional charge to Owner.
11. The SCS Contractor shall provide test documentation to the Owner's Project Manager in CD format and / or USB thumb drive within three weeks after the completion of a specific project. These shall be clearly marked on the outside front cover with the words "Test Results", the project name, and the date of completion (month and year). The documentation shall be divided by test type. A paper copy of the test results shall be provided that lists all the links that have been tested, and include link name, overall pass/fail evaluation, date and time of test, cable type and NVP value. Detailed test results shall be provided for each link tested and shall include length, propagation delay, delay skew, insertion loss, return loss, NEXT, ELFEXT, ACR, PSNEXT, PSELFEXT, and PSACR. Detailed test results for each link will also include customer site name, name of standard selected to execute the tests, date and time test results were saved in memory of test unit, brand name model and serial number of tester and revision of the tester software and test standards database in the tester. Individual test data within each section shall be presented in the sequence listed in the test summary records. Unless a more frequent calibration cycle is specified by the manufacturer, an annual calibration cycle is anticipated on all test equipment used for this installation.
 12. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be collocated in the document.
 13. The entire SCS system shall be warranted free of mechanical or electrical defects by the Contractor for a period of one (1) year after final acceptance of the installation.
 14. Any equipment that is not installed per the manufacturer's recommendation shall be replaced promptly and at no cost to the Owner.
 15. Any material showing mechanical or electrical defects shall be replaced promptly at no expense to the Owner.
 16. Provide all labor and material warranties for each system, as described elsewhere in this document.
 17. At the Owner's direction, the Contractor shall perform additional random testing which shall consist of a random sample of up to 10% of each installation distribution system. The Contractor shall assume responsibility for providing the

proper test equipment and staff to conduct tests. The Owner's representative shall witness the tests.

18. Should the initial 10% test not be 100% successful (all drops testing over CAT6A up to 500MHz), the Contractor shall assume responsibility to repair/replace non-passing links, at the direction of the Owner, and the links to re-verify and resubmitted. A 20% random sample shall then be conducted to ensure proper performance of the system.
19. Should there be failure in this re-test, the Contractor shall be responsible to repeat the re-test procedure until such time as all cabling is verified.

3.7 COMPLETION OF WORK:

- A. At the completion of the Systems, the SCS Contractor shall restore to its former condition, all aspects of the project site, and daily shall remove all waste and excess materials, rubbish debris, tools and equipment resulting from or used in the services provided under this Contract. All clean up, restoration, and removal noted above will be by the Contractor and at no cost to Owner. If the Contractor fails in its duties under this paragraph, Owner may upon notice to the Contractor perform the necessary clean up and deduct the costs thereof from any amounts due or to become due to the Contractor. It shall be the Contractor's responsibility to remove trash from the areas it is working in and bring trash and debris to the Contractor provided dumpster.

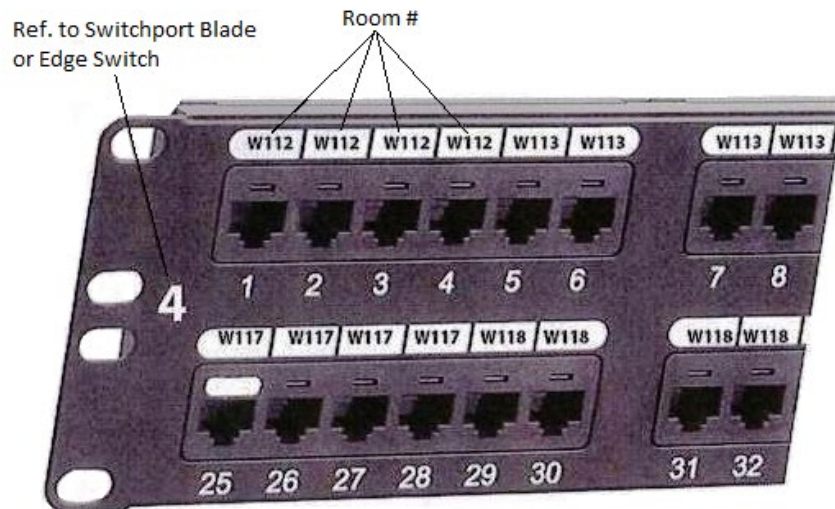
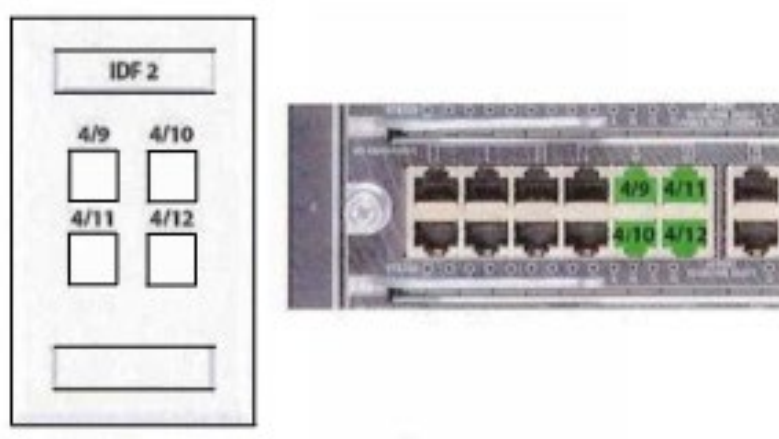
3.8 INSPECTION

- A. On-going inspections shall be performed during construction by the Owner's representative. All work shall be performed in a high-quality manner and the overall appearance shall be clean, neat, and orderly. Any work that does not meet the Owner's representative's approval shall be removed and reinstalled by the Contractor at no additional cost to the Owner.

3.9 LABELING REQUIREMENTS

- A. Owner shall supply Contractor with all label information in Microsoft Excel format or an asset tag, as needed. Contractor shall coordinate with Owner in the field by issuing an RFI for clarification prior to Contractor creating any labels. The Contractor shall provide and install labels per this document. If the Owner doesn't provide label information, the Contractor shall create labels in the format as outlined in this document.
- B. Numbers must be assigned to each outlet location using a logical designation convention. Blueprints with the outlet placement and configuration information have been furnished to the Contractor. Contractor will provide the equipment as necessary to generate Panduit PAN-CODE (or Equal) laser printer generated self-laminating labels using the numbering convention shown below and as specified herein. Before any permanent labels are installed on blocks, face plates or cables, Contractor shall submit a sample label of each various type listed below to Owner's Project Manager for written approval to ensure compliance with the labeling scheme, legibility, etcetera. Contractor is responsible to provide the labeling scheme as described herein.

- C. Station Faceplate (telecommunications equipment outlet) Labeling. The following is illustrative of the number convention to be used:
1. Top Window: IDF-2. This identifies the IDF location where cable originates within the building (i.e., IDF room “#2”).
 2. Bottom Window: blank. For future use.
 3. Faceplate jacks shall be numbered sequentially from top to bottom and left to right. Individual jack labels shall indicate Patch Panel number / port number. (i.e., 4/9 represents patch panel #4, patch panel port #9).



- D. Network Switch Labeling. All rack mounted Ethernet edge switches shall be sequentially numbered. Number shall be printed and attached to the left edge and centered. Numbers shall be minimum 1/2" high and printed white on a black background.
- E. Patch Panel Labeling. All copper category 6A rack mounted patch panels shall be sequentially numbered, beginning with the uppermost panel in the rack. Patch panel number shall be printed and attached to both left and right edges and centered.

Numbers shall be minimum 1/2" high and printed white on a black background. Patch panel ports shall be labeled with the corresponding room number where the cable's faceplate is located. Cables shall be terminated sequentially by room number and faceplate order.

- F. Station Cable Jacket Labeling. All cables shall be labeled between three and six inches of each termination end (e.g., at Both Ends, the outlet end and MDF/IDF end) using machine-generated, "P-Touch" type, self-laminating cable markers.
1. Example: IDF2-4/9
 2. IDF location where cable originates (e.g., IDF room "#2").
 3. Patch panel and port numbers where cable terminates (e.g., patch panel #4, port #9)
- G. Backbone and Riser Multipair Cable Labeling. All backbone and riser cables (copper, fiber, coax, etc.) will be labeled to reflect the origin and destination abbreviation for the cable and pair counts on large font (16 pitch) self-laminating labels, which shall be located within 18 inches of each end of the cable. Labels shall be placed on the cable to be visible without relocating surrounding cables.
1. Example #1: IDF2/IDF3/CP100/01
 2. IDF2: Cable Origination
 3. IDF3: Cable Destination
 4. CP100: Cable Type & Pair or Strand Count (e.g., 100 – pair Copper Cable. Other possibilities include CX for coax, HB for hybrid fiber cable, MM for multimode cable, and SM for single mode cable.)
 5. 01: Cable identification number (e.g., cable 01). There may be more than one backbone or riser cable with the same origin, destination, and pair count.
- H. Multipair Cable Termination Block Labels. All multipair cables will be labeled using appropriate terminal-block label strip with label holders. Termination blocks shall be labeled in such a manner to indicate Termination Block number (e.g., W1, W2, etc.) and type of cables (e.g., Fire Alarm-FA, Security Alarm-SE, Paging-PA, FAX machine, etcetera).
1. Termination Block Label:
 2. Example: W1 – Alarm Cables 1st Floor
 3. W1: Wall Field 100-pair 110-block #1
 4. Individual cable numbers on label strip:
 5. Example: 001

6. Station #1
 - I. Multipair Cable Termination Block Labels. All multipair riser blocks shall be labeled using appropriate terminal-block label strip with label holders and shall follow the labeling scheme outlined above. Building interconnect cable termination block labels shall be per ANSI/TIA/EIA-606-B. Final label scheme shall be determined by the Owner's decision.
 - J. Fiber Enclosure Labels. All fiber enclosures and panels will be labeled using self-laminating laser label markers. Fiber labels shall include all information as specified by the Owner. Contractor is responsible to provide a labeling scheme that meets with the Owner's satisfaction. At a minimum, the fiber enclosure label card shall indicate: destination of connected cables, slash (/), origination of connected cables, slash (/), and the fiber enclosure number and port number.
 1. Example: MDF/IDF2/1-1
 2. MDF: Destination Patch Panel Location Designation
 3. IDF2: Origination Patch Panel Location Designation
 4. 1-1 Indicates fiber enclosure number and fiber port number on both origin and destination fiber enclosures.
 - K. Equipment Rack/Cabinet Labeling: All equipment racks/cabinets shall be labeled according to their room identifier and a two-digit number. The labels will be engraved plastic plates, with 1"-high white letters on black background. The labels will be attached to the cross member at the top front of each frame or rack with appropriately sized sheet metal screws. Self-adhesive strips, glues, etcetera are unacceptable. Racks and cabinets within the same room shall be numbered sequentially from left to right, when facing the front of the racks/cabinets.
 1. Example: MDF-01
 2. MDF. Room Designation
 3. 01. Rack Identifier
 - L. Innerduct and Fiber Cable Warning Labeling. The Contractor shall provide and install tags of stamped plastic for tube cable and innerduct. The labeling convention described above within Paragraph E shall apply. Additionally, the Contractor will also install fiber optic warning tags (Panduit #PST-FO) every 12 feet on all exposed fiber optic cable and on innerduct containing fiber optic cable installed within the building, also on innerduct and cable visible in each pull box, manhole, and vault.
 - M. MDF/IDF Floor Plan Mounting Frame: Provide wall mountable floor plan mounting frame with removable Plexiglas front cover in each MDF/BDF/IDF. Frame and cover shall be sized to house 30"x42" floor plan drawing. Coordinate location of frame with Owner's Project Manager prior to installation.

- N. Telecommunications Main Grounding Busbars (TMGB, TGB): All telecom grounding busbars shall be labeled using large font (16 pitch) self-laminating labels. Labels shall indicate "TMGB" or "TGB". If more than 1 busbar is in the room, include a numerical indication (e.g., TMGB-1).

3.10 MISCELLANEOUS PROJECT REQUIREMENTS

- A. Site Cleaning: The Contractor shall keep the working area free from debris of all types. Daily the Contractor shall remove from the premises all rubbish resulting from any work done by Contractor. The work site shall be in order at all times when work is not actually being performed and shall be maintained in a reasonably clean condition at all times.
- B. Conduits: All backbone cabling will run through dedicated conduits. All new conduits will be supplied with a pull string. SCS Contractor shall supply pull string and pull rope for the installation of all cables in existing conduits. For all conduits with available capacity, SCS Contractor shall replace pull strings with 1/4-inch pull rope during his work. Contractor must seal all underground low voltage conduits within manholes, underground vaults/pull boxes, and underground conduits that enter a facility, with an approved mechanical water/gas/airtight plug. Unused conduits shall be sealed with a blank plug. Expanding foam type sealant is prohibited.
- C. Seismic Requirements: SCS Contractor will install all equipment racks, equipment cabinet enclosures, cable runways, etcetera, according to DSA and local, state and/or federal code. Contractor will notify Owner's Project Manager of such requirements and shall provide such bracing as required at no additional increase to the base bid. Contractor to coordinate all installation with the structural Engineer of Record.
- D. Safety Requirements: SCS Contractor will utilize appropriate personnel and display warning signs, signals, flags and/or barricades at the work site to ensure adherence to safety regulations and as prudence requires.
- E. Specification/Drawing Status: All specifications and drawings related to this project will be "frozen" after shop drawing approval. The Owner reserves the right to negotiate any future changes with the Contractor at any time.

3.11 MISCELLANEOUS SUPPORT REQUIREMENTS

- A. Upon approval of shop drawings, SCS Contractor shall immediately place orders for all required materials, components, and supplies. In addition, Contractor shall secure and forward written confirmations (including orders and shipping dates) direct from each manufacturer/vendor to the Owner's Project Manager.
- B. SCS Contractor shall expedite shipment of all materials, components, and supplies, as necessary to ensure the successful completion of the Project by the date required. All costs for expediting shall be included within Contractor's base bid.
- C. All equipment and supplies required for work shall be stored off-site by Contractor and delivered just in time for installation (within 15 days of install). No claim for allowances of time, storage, or money will be accepted.

- D. Minimum standards for maintenance purposes shall include optional access to service on a 24 hour-a-day, 365 day-a-year basis. In addition, Contractor shall, upon notification, respond as follows:
1. Emergency Response: Contractor must respond by utilizing remote diagnostics capabilities (as applicable) within thirty minutes of notification. If necessary, Contractor must dispatch at least one certified technician for arrival on-site within two hours of notification.
 2. Non-Emergency Response: Contractor shall respond by utilizing remote diagnostics capabilities and or cause dispatch of at least one certified technician for arrival on-site within one business day of notification.
 3. Definition of "Emergency": For maintenance purposes, "emergency" shall be defined as one or more of the following conditions:
 - a. Defects of any riser pairs and/or components involving at least ten percent (10%) of any riser cable's capacity.
 - b. Defects of station cable pairs and/or components involving at least ten percent (10%) of any department or group of voice and/or data stations.
 - c. Defects significantly impairing any single attendant console.
 - d. Defects of any fiber optic cable and/or components involving at least ten percent (10%) of any department or group's fiber-based systems and/or stations.
 - e. Any pre-defined failure as submitted by Owner and agreed to be Contractor.

3.12 TRAINING

- A. The Contractor shall provide training for at least five (5) Owner representatives with a minimum allotment of two (2) two-hour sessions. All training shall include written and/or video materials that shall remain the property of Owner. If materials are written, they shall be provided in quantities sufficient for each person trained; if materials are video, one (1) copy of each will be required. The administration/maintenance training shall include, but not be limited to, the following:
1. Review of all deliverables including as-built documentation, drawings, test results.
 2. Review of all warranty information.
 3. Site inspection of MDF/IDF room rack and cabinet equipment layouts

3.13 FINAL ACCEPTANCE

- A. The Owner or Owner's representative may visit the site during the installation of the system to ensure that correct installation practices are being followed.

- B. The Owner or Owner's representative will conduct a final job review once the Contractor has finished the job. Review will take place within one (1) week after the Contractor notifies Owner.
- C. Two (2) copies of all certification data and drawings for all identifications shall be provided to the Owner before the Owner's review.
- D. The Owner or Owner's representative will review the installation and certification data prior to the system acceptance.
- E. The Owner or Owner's representative may test some of the systems features to ensure that the certification data is correct. If a substantial discrepancy is found, the Owner reserves the right to have an independent consultant perform a certification of the entire system. If such a procedure is undertaken, the cost of the testing will be billed back to the Contractor.
- F. If repairs or adjustments are necessary, the Contractor shall make these repairs at his own expense. All repairs shall be completed within ten (10) days from the time they are discovered.
- G. The Contractor shall provide two (2) copies of an "operating and servicing manual" for the system within fourteen (14) calendar days of Owner's final acceptance of the system. The manuals shall be bound in flexible binders. All data shall be printed material or typewritten. Each manual will include the following: instructions necessary for proper operation and servicing of the system; complete as-built installation drawings of the system (11"x17"); equipment specification cut sheets, complete performance test data, complete warrantee information and replacement parts list with current prices listed, contact information for repair and warranty work requests.
 - 1. The Contractor shall mount a full size 30" x 42" bond copy of each scaled Site Plan within MDF room and each IDF room with removable Plexiglas front cover. Frame and cover shall be sized to house the site plan and floor plan drawings. Coordinate location of frame with Owner's Project Manager prior to installation.
 - 2. The Contractor shall hand to the Owner a copy of any applicable installation specific software configurations including all log-in passwords on CD or USB drive in .docx format.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Removal of vegetation, grass, grass roots, shrubs, tree stumps, trees, upturned stumps, weed growth, tree roots, brush, masonry, concrete, rubbish, debris and other materials.
2. Removal of concrete and bituminous surfaces.
3. Removal of existing fences and gates.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 31 2200 - Grading.
3. Section 31 2313 - Excavation and Fill.
4. Section 31 2316 - Excavation and Fill for Pavement.
5. Section 31 2319 - Excavation and Fill for Structures.
6. Section 31 2323 - Excavation and Fill for Utilities.
7. Section 31 2326 - Base Course.
8. Section 32 3113 - Chain Link Fences and Gates.
9. Section 32 9000 - Planting.

1.02 SUBMITTALS

- A. Shop Drawings: Submit site plan indicating extent of site clearing.

1.03 QUALITY ASSURANCE

- A. Comply with Standard Specifications for Public Works Construction, current edition, as a minimum requirement.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 TREE AND STUMP REMOVAL

- A. Remove trees and stumps indicated or required to be removed. Remove trees, together with bulk of roots, to a minimum depth of 4 feet below required grade, and within a radius of approximately 7 feet beyond perimeter of trunk at grade.
- B. Fill and compact excavation from tree and stump removal. Fill in 6 inch layers, each compacted to 90 percent of maximum density in accordance with ASTM D1557.
 - 1. Back filling shall not commence until the excavation is inspected and tested.

3.02 CONCRETE AND BITUMINOUS SURFACING REMOVAL

- A. Break up and completely remove existing concrete surfacing, curbs, gutters, walks and bituminous surfacing to indicated limits. Cutting shall be performed to a neat and even line with proper tools or a concrete cutting saw. Minimum depth of cut shall be 1 1/2-inch, unless otherwise indicated. Remove concrete broken beyond the indicated limits to the nearest joint or score line and replace with new concrete to match existing.

3.03 FENCING

- A. Existing fences scheduled to remain may be removed to facilitate the Work, provided they are installed to their original condition in accordance with requirements of Section 32 3113 - Chain Link Fences and Gates.
- B. Fencing indicated to be removed and not reinstalled shall be completely removed, including footings. Fill and compact excavations.
- C. Install chain link fencing indicated to be relocated or reset in accordance with applicable requirements specified under Section 32 3113 - Chain Link Fences and Gates.

3.04 CLEANUP

- A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 31 11 00

SITE CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 SUMMARY

- A. Clearing vegetation, debris, trash and other materials within limits indicated.
- B. Grubbing of vegetation within limits indicated.

1.2 RELATED SECTIONS

- A. Section 31 31 19 Vegetation Control
- B. Section 32 93 01 Tree Pruning

1.3 RELATED DOCUMENTS

- A. California Building Code: Site Work, Demolition and Construction.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 PREPARATION

- A. Locate and clearly flag vegetation to remain or to be relocated.

3.2 RESTORATION

- A. Repair or replace vegetation indicated to remain that is damaged by construction operations, as directed by the Owner.
- B. Employ a qualified arborist, licensed in jurisdiction where the Project is located, to submit details of proposed repairs and to repair damage to shrubs.

3.3 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
- B. Remove trash, debris, logs, concrete, masonry and other waste materials.
- C. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.

- D. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18-inches below subgrade.
- E. Use only hand methods for grubbing within drip line of remaining trees.

END OF SECTION

SECTION 31 22 00

GRADING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. General exterior grading, cutting and filling, including grading for building area, paving, planting areas, banks and hillsides.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 31 1000 - Site Clearing.
3. Section 31 2313 - Excavation and Fill.
4. Section 31 2316 - Excavation and Fill for Pavement.
5. Section 31 2319 - Excavation and Fill for Structures.
6. Section 31 2323 - Excavation and Fill for Utilities.
7. Section 31 2326 - Base Course.
8. Section 32 9000 - Planting.

1.02 PROJECT REQUIREMENTS

A. General:

1. Fees: Pay as required by authorities having jurisdiction over the area.
2. Bonds: Post as required by authorities having jurisdiction over the area.
3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.
4. Before grading, contact Underground Service Alert of Southern California (USASC) for information on public buried utilities and pipelines. Retain the services of an underground utility locator for on-site utilities.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Materials shall conform to requirements specified in this and related sections.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect and maintain installed stakes until their removal is required for the Work. Provide replacement grade or location stakes lost or disturbed.
- B. Install grade stakes and compare to indicated grades. If discrepancies are found between existing grades and grades indicated on Drawings, do not proceed until discrepancies are resolved.

3.02 ROUGH AND FINE GRADING

- A. Rough grade area sufficiently high to require cutting by fine grading:
1. Grade area for bituminous surfacing and other paving to the indicated grades, equal to the section of the indicated base and pavement.
 2. Slope banks to required finish grades as cut progresses or leave cuts full and finish grade by mechanical equipment to provide grades and soil densities indicated on the Drawings.
 3. Rough grade, fill and compact banks beyond indicated finish grades. Finish grade banks and slopes to indicated grades and specified soil densities.
 4. Grade Only Areas: In areas not indicated to receive pavement, rough grade to approximate finish grades and then scarify, moisten and roll to obtain required density and indicated finish grades.
 5. Tolerances: Finish grades shall be within a tolerance of 0.05 inch per foot above or below grades indicated. Provide an average grade as indicated.
- B. Base or Subgrade:
1. After subgrade has been constructed to approximate required grades, scarify to a depth of at least 6 inches:
 - a. After scarifying, process loosened material to a finely divided condition and adjust moisture content to optimum condition by addition of water, addition and blending of dry suitable material, or by drying of existing material.
 - b. Subgrade material shall be compacted by tamping, sheepfoot rollers or pneumatic tire rollers. Required relative compaction shall be 90 percent minimum for the top 6 inches below subgrade.
 - c. Install base course in accordance with Section 31 2326 - Base Course.

2. Tolerance of completed grades of base or subgrade shall not vary more than 0.03 inch per foot from grades indicated. Provide an average grade as indicated.
- 3.03 SHORING
- A. Provide shoring as necessary to properly and safely support earth sides of excavations, and existing curbs, sidewalks, gutter, drives and stairs, against movement and collapse.
 - B. Design and Calculations: Provide in accordance with requirement of CalOHSA.
 - C. Remove shoring upon completion of the Work of this section or when no longer needed unless required otherwise by authorities having jurisdiction.
- 3.04 EXCESS MATERIAL DISPOSAL
- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.
- 3.05 PROTECTION
- A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 31 23 13

EXCAVATION AND FILL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Excavating, filling, backfilling, and compacting for Project site pavement, planting areas, buildings, and other structures.
2. Trenches for utility lines such as water, gas, irrigation, storm drain and sewer lines, concrete-encased conduits, manholes, vaults, valve boxes, catch basins, underground tanks, thrust blocks, yard boxes, pull boxes, and other utility appurtenances.

B. Related Requirements:

1. Section 31 1000 - Site Clearing.
2. Section 31 2200 - Grading.
3. Section 31 2326 - Base Course.
4. Section 32 0117 - Pavement Repair.
5. Section 32 1313 - Site Concrete Work.
6. Section 32 8413 - Potable Water Irrigation.
7. Section 32 8426 - Reclaimed Water Irrigation.
8. Section 33 1100 - Site Water Distribution Utilities.
9. Section 33 3000 - Site Sanitary Sewer Utilities.
10. Section 33 4000 - Storm Drainage Utilities.

1.02 PROJECT REQUIREMENTS

A. Import and Export of Earth Materials:

1. Fees: Pay as required by authorities having jurisdiction over the area.
2. Bonds: Post as required by authorities having jurisdiction over the area.
3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

1.03 SUBMITTALS

A. Shoring calculations as required in Article 3.03 of this Section.

1.04 QUALITY ASSURANCE

- A. Comply with the Standard Specifications for Public Works Construction, current edition, except as modified herein.
- B. Sampling, testing, and certification of imported and exported soils shall be performed in accordance with Section 01 4524, Environmental Import/Export Materials Testing.

1.05 TESTING

- A. OWNER will retain a Geotechnical Engineer as an OWNER Consultant who will provide observations, tests, inspections and approvals identified in the Contract Documents as being responsibility of OWNER.
- B. Imported Soils: The Geotechnical Engineer will obtain initial product Sample for testing in accordance Article 3.05 of this Section.

1.06 PROJECT CONDITIONS

- A. Information on Drawings or in soil investigation report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.

PART 2 - PRODUCTS

2.01 FILL AND BACKFILL MATERIALS

- A. Fill and backfill material shall be a granular material previously removed from excavation or imported fill material, free of clods and stones larger than 3 inches, (2½ inches for utility trenches) foreign materials, vegetable growths, sod, expansive soils, rubbish and debris. Material shall conform to these specified requirements and related sections.
- B. Fill material exhibiting a wide variation in consistency and moisture content shall be blended and aerated to stabilize and upgrade the material.
- C. Bedding material from trench bottom to one foot above the pipe:
 - 1. Sand, gravel, crushed aggregate or native free-draining granular material providing a sand equivalent of at least 30 or a coefficient of permeability greater than 1.4 inches per hour.
 - 2. Sand complying with the Specifications for cement concrete aggregates.
- D. Brick rubble and broken concrete originating from the Project site shall be legally disposed of off the Project site No such material shall be imported from outside the Project site.
- E. Permeable Backfill:
 - 1. Provide permeable backfill material behind retaining structures consisting of gravel, crushed gravel, crushed rock, natural sands, manufactured sand, or combinations of these materials conforming to the following gradations:

<u>Sieve Size:</u>	<u>Percentage Passing:</u>
3/4 inch (19mm)	100

3/8 inch (10mm)	80 to 100
No. 100	0 to 8
No. 200	0 to 3

2. Those portions of fill material passing a No. 4 sieve shall provide a sand equivalent of at least 60.
3. Provided backing for weep-holes shall consist of two cubic feet of aggregate in burlap sacks, securely tied. Aggregate shall conform to requirements for No. 3 concrete aggregate as specified in subsection 200-1.4 of the Standard Specifications for Public Works Construction.
4. Permeable Backfill Alternate Materials: Instead of the materials specified for retaining structures backfill, a drainage matting system Miradrain by Mirafi, Inc., American Wick Drain, JDR Enterprises, or equal, may be provided if reviewed and approved by the ARCHITECT.

- F. Cement-sand slurry shall be provided with one sack of cement per cubic yard of the mixture.

2.02 BASE MATERIALS

- A. Concrete Slabs on Grade: Provide "Crushed Aggregate Base" as specified in Standard Specifications for Public Works Construction, Section 200 - Rock Materials, with 3/4 inch maximum size aggregates. Provide 3 inch thick base, unless noted otherwise.
- B. Bituminous Surfacing: Provide as indicated on Drawings and specified in Section 31 2326 Base Course.

PART 3 - EXECUTION

3.01 GENERAL

- A. Before initiating intrusive activities, contact Underground Service Alert of Southern California (USA or Dig Alert) to obtain a Dig Alert ticket for location information on buried public and USA member utilities and pipelines at least 48-hours prior to beginning work. A copy of the Dig Alert ticket shall be forwarded to the OWNER. For on-site utilities, retain a state-licensed third party underground utility locating service.
- B. Where the Work includes a building extension or addition on an occupied Project site, perform Work in such a manner, and at such times, as not to disrupt performance of existing utility services to existing Project site facilities. Where an interruption is necessary, obtain review from the OAR before proceeding.
- C. Remove concrete or bituminous pavement to straight lines by saw cutting.

3.02 PROTECTION

- A. Protect and guard excavations against danger to life, limb, and property as required by, but not limited to, OSHA regulations.
- B. Protect existing improvements including landscaping against damage. Repair or replace damaged items.

- C. Protect existing utility services and distribution systems from damage or displacement.
- D. Remove conduits or pipes not in service, exposed during Work, unless a minimum cover of two feet is provided. Remove concrete, clay or other non-metallic pipe over 8 inches in diameter, unless otherwise indicated.
- E. Shore, crib, or lag excavations and earthen banks as necessary to prevent cave in, erosion or gulying of sides.
- F. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. If soil becomes soft, soggy, or saturated, excavate to firm undisturbed earth and fill as required. Slope adjacent grades away from excavations to minimize entry of water.

3.03 SHORING

- A. Provide shoring as necessary to properly and safely support earth sides of excavations, and existing curbs, sidewalks, gutter, drives and stairs, against movement and collapse.
- B. Design and Calculations: Provide in accordance with requirement of governing Cal-OSHA requirements.
- C. Remove shoring upon completion of the Work of this Section or when no longer needed unless required otherwise by authorities having jurisdiction.

3.04 EXCAVATION

- A. Unclassified Excavations: Comply with the Standard Specifications for Public Works Construction, Section 300: "Earthwork", except as modified herein.
- B. Form sides of footings, pads, grade beams, and slab foundations, unless otherwise indicated. Provide excavations of sufficient size to permit installation and removal of forms and other required Work.
- C. Machine-drill excavation for round footings to size and depth indicated. Provide a collar or casing, or other adequate protection, to exclude dirt and debris. Protect excavations with plank covers until concrete is placed.
- D. Provide excavation bottoms level and free from loose material. Excavate to indicated or required elevations of undisturbed earth.
- E. Barricade trenches, ditches, pits, sumps, and similar Work outside the barricaded working area with chain link fence as specified in Section 01 5000 - Construction Facilities and Temporary Controls, and in accord with Cal-OSHA standards and requirements.
- F. Trenches over five feet in depth shall comply with the Construction Safety Orders of the California Division of Industrial Safety.
- G. Where indicated or required to excavate in lawn areas, protect adjoining lawn areas outside of the Work area. Replace or install removed sod upon completion of backfill by installing sod level with adjacent lawns. If installation of removed sod fails, furnish sod and install to match existing lawns.

H. For Structures:

1. Calculate excavation quantities based on elevations or depths indicated on Drawings.
2. Provide 2,000 psi concrete for backfill of over-excavated areas to indicated or required elevations.
3. Special preparation of bottom of excavated planes areas: Excavate areas shown on Drawings as bottom of excavated planes (B.E.P.), by excavating and filling to indicated grades and elevations.

I. For Utilities:

1. Excavate trenches to required depth for utility lines, such as pipes, conduits, and tanks, with minimum allowance of 6 inches at the bottom and 6 inches at the sides for bedding or concrete encasement as indicated on Drawings. Grade bottom of trenches to a uniform smooth surface. Remove loose soil from the excavation before placing sand bedding or concrete encasement.
2. Do not install piping lengthwise under concrete walks without review by the ARCHITECT.
3. Do not excavate trenches parallel to footings closer than 18 inches from the face of the footing or below a plane having a downward slope of two horizontal to one vertical, from a line 9 inches above bottom of footings.

- a. Unless otherwise indicated on Drawings, depth of excavations outside buildings shall provide for a minimum coverage above top of piping, tank or conduit measured from the lowest adjoining finished grade, as follows:

Steel Pipe	24 inches below finish grade
Copper Water Tube	18 inches below finish grade
Cast-Iron, Pressure Pipe	36 inches below finished grade
Plastic Pipe (other than waste)	30 inches below finished grade
Tanks or other structure	36 inches below finished grade
Soil, sewer and storm drain	minimum 18 inches below finished grade, and as required for proper pitch and traffic load. Install polypropylene sewer pipe with at least 24 inches of coverage.
Irrigation Pipe:	Non-pressure pipe - 12 inches, pressure pipe - 24 inches.

- b. Trench width shall provide space for fitting and joining. Excavate for piping bells and fittings, bell and spigot pipe and other fittings.
4. Where portions of existing structures, walks, paving, or other improvements are removed or cut for piping or conduit installation, replace the material with

equal quality, finished to match adjoining existing improvements. Repair pavement as specified in Section 32 0117 - Pavement Repair.

5. Provide a minimum clear dimension of 2 inches from sides of wall excavation to outer surfaces of buried pipes or conduits placed in the same trench or outside surfaces of containers and tanks.

3.05 IMPORT/EXPORT OF MATERIALS

- A. Unclassified Fill and Compaction: Comply with the Standard Specifications for Public Works Construction, Section 300 - Earthwork, except as modified herein. Install and compact fill in layers not to exceed 6 inches in thickness.
- B. Provide fill materials as specified in Part 2- Products. If excavated materials from the Project site are not of required quality or sufficient quantity, import additional materials as necessary.
- C. In addition to the requirements of this Section, import and/or exported materials shall comply with the requirements of Section 01 4524, Environmental Import/Export Materials Testing.
- D. Imported fill materials shall be sampled by the Geotechnical Engineer, for compliance with the requirements of Part 2 of this Section.
- E. The Geotechnical Engineer, will submit the samples to an independent DSA approved testing laboratory for testing.
- F. Initial sampling and testing shall be performed before importing material to the Project site. Identify the location of the source site in addition to the address, name of the person and entity responsible for the source site. The Geotechnical Engineer, will obtain both the initial and additional samples from the identified site and submit samples for required testing.
- G. The Geotechnical Engineer will perform additional sampling during import operations. If the total quantity of import is determined to be greater than 1000 cubic yards of material, one sample shall be obtained and submitted for testing for each 250 cubic yards of imported material. If the total quantity of import is determined to be less than 1000 yards, one sample shall be obtained and submitted for testing for each 100 cubic yards of imported material.
- H. The independent approved testing laboratory will perform the required tests and report results of tests noting if the tested material passed or failed such tests and will furnish copies to the Project Inspector, ARCHITECT, OAR, DSA, CONTRACTOR, and others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, California Building Code, and the DSA. Upon completion of the Work of this Section, the independent testing laboratory and Geotechnical Engineer will submit a verified report to the DSA as required by the CBC.
- I. Bills of lading or equivalent documentation will be submitted to the Project Inspector on a daily basis.

- J. Upon completion of import operations, provide the OAR a certification statement attesting that imported material has been obtained from the identified source site.

3.06 INSTALLATION OF MATERIALS

- A. Pavement: Fill or backfill materials shall be installed in horizontal layers of 6 inches, unless otherwise required. Each layer shall be evenly placed and moistened or aerated as necessary. Unless otherwise reviewed by the Geotechnical Engineer, each layer of fill material shall cover the length and width of the area to be filled before the next layer of material is installed. Top surface of each layer shall be installed to an approximate level with a crown or crossfall of at least 1 in 50, but not more than 1 in 20. Provide adequate drainage at all times during installation of the Work of this Section.

- B. Structures:

- 1. After concrete has been placed, forms removed, and concrete Work inspected, backfill excavations with earth to indicated or required grades. Backfill simultaneously on each side of walls or grade beams. Remove rubbish, debris and other waste materials from excavations before placing backfill.
- 2. Before placing backfill, adequately cure concrete and provide bracing, if required to stabilize structure. Protect waterproofing or damp-proofing against damage during backfilling operations, with required protection board. Remove bracing as backfill operation progresses.
- 3. Do not furnish or install expansive soils for retaining wall backfill.
- 4. Rigidly control the amount of water to be installed to provide optimum moisture content for type of fill material furnished. Do not over-saturate or compact by flooding or jetting.
- 5. Install wall backfill before installing railings and fences on walls.
- 6. Install weep hole drainage at the backside of walls so the backing completely covers the weep holes, is horizontally centered and extends at least 12 inches above the bottom of the weep opening. Provide an 8-inch square section of 1/4 inch galvanized or aluminum screen, with a minimum wire diameter of 0.03 inch, and install at the backside of each weep hole before installing the backfill material.
- 7. Where a reviewed drainage matting system is provided instead of permeable backfill for retaining structures, install in accordance with the manufacturer recommendations.

- C. Utilities:

- 1. Do not install backfill until the Work of this Section has been inspected and tested. Do not furnish or install materials excavated from the Project site containing materials not permitted for backfill.
- 2. Backfill electrical or other excavated utility trenches located outside of barricaded installation areas within 24 hours after inspection by the IOR.

3. Install backfill in layers not exceeding 4 inches in thickness, except cement-sand slurry.
4. If materials excavated from the Project site are not permitted for trench backfill in paved areas, backfill trenches with a cement-sand slurry mix. Install backfill to an elevation of the existing undisturbed grades plus one inch.

3.07 COMPACTING

- A. Each layer of fill material shall be compacted by tamping, sheepsfoot rollers, or pneumatic-tired rollers to provide specified relative compaction. At inaccessible locations, provide specified compaction by manually held, operated and directed compaction equipment.
- B. Install and compact sand bedding to provide a uniform bearing under the full length of piping and conduits.
- C. Unless otherwise indicated, compact each layer of fill material to a relative compaction of at least ninety percent.
- D. When fill materials, or a combination of fill materials, are encountered or provided which develop densely packed surfaces as a result of installation or compacting operations, scarify each layer of compacted fill before installing the next succeeding layer.

3.08 INSPECTION AND TESTING

- A. The Geotechnical Engineer will inspect and test excavations, sample material quality for testing as set required in Part 2 and observe installation and compaction of fill materials.
- B. The Geotechnical Engineer will sample imported fill materials from their designated source and submit samples to the independent approved testing laboratory before delivery to the Project site.
- C. Installation of backfill shall be observed by the Geotechnical Engineer.
- D. The Geotechnical Engineer will inspect and test excavation Work before the installation of fill and other materials.
- E. Compaction: Test compaction in accordance with ASTM D1557, Method C.
- F. The Project Inspector will inspect foundation excavations when completed and ready for forms, after forms are in place, and before first placement of concrete.

3.09 PROTECTION

- A. Protect the Work of this Section until Substantial Completion.

3.10 CLEANING

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 31 23 16

EXCAVATION AND FILL FOR PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Excavating, backfill, and compacting for paved areas.
2. Installation of fill materials.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 01 4524 - Environmental Import/Export Materials Testing.
3. Section 31 1000 - Site Clearing.
4. Section 31 2200 - Grading.
5. Section 31 2323 - Excavation and Fill for Utilities.
6. Section 32 2326 - Base Course.
7. Section 32 0117 - Pavement Repair.
8. Section 32 1216 - Asphalt Paving.
9. Section 32 1313 - Site Concrete Work.

1.02 PROJECT REQUIREMENTS

A. Import and Export of Earth Materials:

1. Fees: Pay as required by authorities having jurisdiction over the area.
2. Bonds: Post as required by authorities having jurisdiction over the area.
3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

1.03 QUALITY ASSURANCE

- A. Comply with Standard Specifications for Public Works Construction, current edition, except as modified herein.

- B. Sampling, testing, and certification of imported and/or exported soils shall be performed in accordance with Section 01 4524 - Environmental Import/Export Materials Testing.

1.04 TESTING

- A. OWNER will retain a Geotechnical Engineer as an OWNER Consultant who will provide observations, tests, inspections and approvals identified in the Contract Documents as being responsibility of OWNER.
- B. Imported Soils: The Geotechnical Engineer will obtain initial product Sample for testing in accordance Article 3.05 of this Section.

1.05 PROJECT CONDITIONS

- A. Information on Drawings or in soils report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.

PART 2 - PRODUCTS

2.01 BASE MATERIALS

- A. Concrete Slabs On Grade: Provide "Crushed Aggregate Base "as specified in the Standard Specifications for Public Works Construction, Section 200: "Rock Materials," with $\frac{3}{4}$ inch maximum size aggregates. Provide 3-inch thick base, unless noted otherwise.
- B. Bituminous Surfacing: As indicated on Drawings and specified in Section 31 2326 - Base Course.

2.02 FILL AND BACKFILL MATERIALS

- A. Fill and backfill materials shall be previously excavated materials or imported fill material, free of clods and stones larger than 3-inch, foreign materials, vegetable growths, sod, expansive soils, rubbish and debris. Material shall conform to these specified requirements and related sections.
- B. Fill material exhibiting a wide variation in consistency and moisture content shall be blended or aerated to stabilize and upgrade the material.
- C. Imported Fill Material:
 - 1. Provide suitable materials obtained from Project site excavations for earthwork and fill materials. If excavated materials are not of suitable quality or sufficient quantity, import additional materials as necessary.
 - 2. Imported fill shall be a granular material with sufficient binder to form a firm and stable unyielding subgrade and shall not have more than 60 percent of fines passing 200 mesh sieve. Material shall have a coefficient of expansion of not more than 2 percent from air dry to optimum moisture content and not more than 6 percent from air dry to saturation. Imported material shall be

clean and free of rubbish, debris, and toxic or hazardous contaminants. Adobe or clay soils are not permitted.

- D. Brick rubble and broken concrete originating from the Project site shall be legally disposed of off the Project site. No such materials shall be imported from outside the Project site.
- E. Permeable Backfill:
 - 1. Provide permeable backfill material behind retaining structures consisting of gravel, crushed gravel, crushed rock, natural sands, manufactured sand, or combinations of these materials conforming to the following gradations:

Sieve Size:	Percentage Passing:
3/4 inch (19mm)	100
3/8 inch (10mm)	80 to 100
No. 100	0 to 8
No. 200	0 to 3
 - 2. Those portions of fill material passing a No. 4 sieve shall provide a sand equivalent of at least 60.
 - 3. Provided backing for weep holes shall consist of two cubic feet of aggregate in burlap sacks, securely tied. Aggregate shall conform to requirements for No. 3 concrete aggregate as specified in subsection 200-1.4 of the Standard Specifications for Public Works Construction.
 - 4. Permeable Backfill Alternate Materials: Instead of the materials specified for retaining structures backfill, a drainage matting system, Miradrain by Mirafi, Inc., or equal, may be provided if reviewed and approved by the ARCHITECT.

PART 3 - EXECUTION

3.01 GENERAL

- A. Before initiating intrusive activities, contact Underground Service Alert of Southern California (USA or Dig Alert) to obtain a Dig Alert ticket for location information on buried public and USA member utilities and pipelines at least 48-hours prior to beginning work. A copy of the Dig Alert ticket shall be forwarded to the OWNER. For on-site utilities, retain a state-licensed third party underground utility locating service.
- B. Clear the Project site as indicated in Section 31 1000 - Site Clearing.

3.02 PROTECTION

- A. Protect and guard excavations against danger to life, limb, and property as required by, but not limited to, Cal-OSHA regulations.
- B. Protect adjacent existing improvements including landscaping against damage.

3.03 EXISTING UTILITY LINES

- A. Protect existing utility lines from damage or displacement.
- B. Remove conduits or pipes not in service, exposed during Work, unless a minimum cover of 2 feet is provided. Remove concrete, clay or other non-metallic pipe over 8 inches in diameter, unless otherwise indicated.

3.04 EXCAVATION

- A. Unclassified Excavations: Comply with the Standard Specifications for Public Works Construction, Section 300: "Earthwork," except as modified herein.

3.05 FILL

- A. Unclassified Fill and Compaction: Comply with the Standard Specifications for Public Works Construction, Section 300: "Earthwork," except as modified herein.
- B. Provide fill materials as specified in Part 2 - Products. If excavated materials from the Project site are not of required quality or sufficient quantity, import additional materials as necessary.
- C. In addition to the requirements of this Section, import and/or exported materials shall comply with the requirements of Section 01 4524 - Environmental Import/Export Materials Testing.
- D. Imported fill materials will be sampled by the Geotechnical Engineer for compliance with the requirements of Part 2 of this Section.
- E. The Geotechnical Engineer will submit samples to a DSA approved independent approved testing laboratory for testing.
- F. Initial sampling will be performed by the Geotechnical Engineer before importing material to the Project site. Identify the location of the source site in addition to the address, name of the person and/or entity responsible for the source site. The Geotechnical Engineer will obtain both the initial and additional samples from the identified site and will submit samples to the approved independent testing laboratory for testing.
- G. The Geotechnical Engineer will perform additional sampling during import operations. If the total quantity of import is determined to be greater than 1,000 cubic yards of material, one sample shall be obtained and submitted for testing for each 250 cubic yards of imported material. If the total quantity of import is determined to be less than 1,000 yards, one sample shall be obtained and submitted for testing for each 100 cubic yards of imported material.
- H. The independent approved testing laboratory will perform the required tests and report results of tests noting if the tested material passed or failed such tests and will furnish copies to the Project Inspector, ARCHITECT, OAR, DSA, CONTRACTOR, and others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, CBC, and the DSA. Upon completion of the Work of this Section, the

independent testing laboratory and Geotechnical Engineer shall submit a verified report to the DSA as required by CBC.

- I. Bills of lading or equivalent documentation will be submitted to the Project Inspector on a daily basis.
- J. Upon completion of import operations, provide the OAR a certification statement attesting that imported material has been obtained from the identified source site.

3.06 INSTALLATION OF MATERIALS

- A. Fill or backfill materials shall be installed in horizontal layers of 6 inches, unless otherwise required. Each layer shall be evenly placed and moistened or aerated as necessary. Unless otherwise reviewed by the Geotechnical Engineer, each layer of fill material shall cover the length and width of the area to be filled before the next layer of material is installed. Top surface of each layer shall be installed to an approximate level with a crown or crossfall of at least 1 in 50, but no more than 1 in 20. Provide adequate drainage at all times during construction of the Work of this Section.

3.07 COMPACTING

- A. Each layer of fill material shall be compacted by tamping, sheepfoot rollers, or pneumatic-tired rollers to provide specified relative compaction. At inaccessible locations, provide specified compaction by manually held, operated and directed compaction equipment.
- B. Unless otherwise indicated, compact each layer of earth fill to a relative compaction of at least 90 percent.
- C. When fill materials, or a combination of fill materials, are encountered or provided which develop densely packed surfaces as a result of installation or compacting operations, scarify each compacted layer before installing the next succeeding layer.

3.08 INSPECTION AND TESTING

- A. The Geotechnical Engineer will inspect and test excavations, sample material quality as required in Part 2, and observe installation and compaction of fill materials.
- B. The Geotechnical Engineer will sample imported fill materials from their designated source before delivery to the Project site.
- C. Installation of backfill will be observed by the Geotechnical Engineer.
- D. The Geotechnical Engineer will inspect and test excavation Work before the installation of fill and/or other materials.
- E. Compaction: Test compaction in accordance with ASTM D1557, Method C.

3.09 PROTECTION

- A. Protect the Work of this Section until Substantial Completion.

3.10 CLEANING

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 31 23 19

EXCAVATION AND FILL FOR STRUCTURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Excavating, backfilling, and compacting for buildings and structures.
2. Fill materials.

B. Related Requirements:

1. Section 31 1000 - Site Clearing.
2. Section 31 2200 - Grading.
3. Section 31 2616 - Excavation and Fill for Paving.
4. Section 31 2323 - Excavation and Fill for Utilities.

1.02 PROJECT REQUIREMENTS

A. Import and Export of Earth Materials:

1. Fees: Pay as required by authorities having jurisdiction over the area.
2. Bonds: Post as required by authorities having jurisdiction over the area.
3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

1.03 SUBMITTALS

- A. Imported Soils: A Geotechnical Engineer, retained by the Owner as an Owner Consultant, will obtain initial product Sample for testing in accordance with the terms of Article 3.05 of this Section.

- B. Shoring calculations as required in Article 3.03 of this Section.

1.04 QUALITY ASSURANCE

- A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction, current edition, except as modified herein.

- B. Sampling, testing, and certification of imported and/or exported soils shall be performed in accordance with Section 01 4524 - Environmental Import/Export Materials Testing.

1.05 TESTING

- A. OWNER will retain a Geotechnical Engineer as an OWNER Consultant who will provide observations, tests, inspections and approvals identified in the Contract Documents as being responsibility of OWNER.
- B. Imported Soils: The Geotechnical Engineer will obtain initial product Sample for testing in accordance Article 3.05 of this Section.

1.06 PROJECT CONDITIONS

- A. Information on Drawings or in soils report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.

PART 2 - PRODUCTS

2.01 FILL AND BACKFILL MATERIALS

- A. Fill and backfill materials shall be a granular material previously removed from excavation, or imported fill material, free of large clods and stones larger than 3 inches, foreign materials, vegetable growths, sod, expansive soils, rubbish and debris. Material shall conform to these specified requirements and related sections.
- B. Fill material exhibiting a wide variation in consistency and or moisture content shall be blended and/or aerated to stabilize and upgrade the material.
- C. Imported Fill Material:
 - 1. Provide suitable materials obtained from Project site excavations for earthwork and fill materials. If excavated materials are not of suitable quality or sufficient quantity, import additional materials as necessary.
 - 2. Imported fill shall be a granular material with sufficient binder to form a firm and stable unyielding subgrade and shall not have more than 60 percent of fines passing 200 mesh sieve. Material shall have a coefficient of expansion of not more than two percent from air dry to optimum moisture content and not more than six percent from air dry to saturation. Imported material shall be clean and free of rubbish, debris and toxic or hazardous contaminants. Adobe or clay soils are not permitted.
- D. Brick rubble and broken concrete originating from the Project site shall be legally disposed of off the Project site No such materials shall be imported from outside the Project site.
- E. Permeable Backfill:
 - 1. Provide permeable backfill material behind retaining structures consisting of gravel, crushed gravel, crushed rock, natural sands, manufactured sand, or combinations of these materials conforming to the following gradations:

<u>Sieve Size</u>	<u>Percentage Passing</u>
3/4 inch	100

3/8 inch	80 to 100
No. 100	0 to 8
No. 200	0 to 3

2. Those portions of fill material passing a No. 4 sieve shall provide a sand equivalent of at least 60.
3. Provided backing for weep-holes shall consist of two cubic feet of aggregate in burlap sacks, securely tied. Aggregate shall conform to requirements for No. 3 concrete aggregate as specified in subsection 200-1.4 of the Standard Specifications for Public Works Construction.
4. Permeable Backfill Alternate Materials: Instead of the materials specified for retaining structures backfill, a drainage matting system, Miradrain by Mirafi, Inc., or equal, may be provided if reviewed and approved by the ARCHITECT.

PART 3 - EXECUTION

3.01 GENERAL

- A. Before initiating intrusive activities, contact Underground Service Alert of Southern California (USA or Dig Alert) to obtain a Dig Alert ticket for location information on buried public and USA member utilities and pipelines at least 48-hours prior to beginning work. A copy of the Dig Alert ticket shall be forwarded to the OWNER. For on-site utilities, retain a state-licensed third party underground utility locating service.
- B. Clear the Project site as indicated in Section 31 1000 - Site Clearing.

3.02 PROTECTION

- A. Protect and guard excavations against danger to life, limb, and property as required by, but not limited to, Cal-OSHA regulations.
- B. Protect adjacent existing improvements including landscaping against damage.
- C. Shore, crib, or lag excavations and earthen banks as necessary to prevent caving-in, erosion or gullyng of sides.
- D. Divert or de-water excavations until concrete is placed, forms are removed, and backfilling is complete.

3.03 SHORING

- A. Provide shoring as necessary to properly and safely support earth sides of excavations, curbs, sidewalks, gutter, drives and stairs, against movement and collapse.
- B. Design and Calculations: Provide in accordance with requirement of Cal-OHSA. Remove shoring upon completion of Work, or when no longer needed.

3.04 EXCAVATION

- A. Form sides of footings, pads, grade beams, and slab foundations, unless otherwise indicated. Provide excavations of sufficient size to permit installation and removal of forms and other Work as required.
- B. Machine-drill excavation for round footings to size and depth indicated. Provide a collar or casing, or other adequate protection, to exclude dirt and debris. Protect excavations with plank covers until concrete is placed.
- C. Provide excavation bottoms level and free from loose material. Excavate to indicated or required elevations of undisturbed earth.
- D. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. If soil becomes soft, soggy, or saturated, excavate to firm undisturbed soil and fill as required. Slope adjacent grades away from excavations to minimize entry of water.
- E. Calculate excavation quantities based on elevations or depths indicated on Drawings.
- F. Provide 2,000 psi concrete for backfill of over-excavated areas to indicated or required elevations.
- G. Special preparation of bottom of excavated planes areas: Excavate areas designated on Drawings as bottom of excavated planes (B.E.P.), by excavating and filling to indicated grades and elevations.

3.05 IMPORT/EXPORT OF MATERIALS

- A. Provide fill materials as specified in Part 2- Products. If excavated materials from the Project site are not of required quality or sufficient quantity, import additional materials as necessary.
- B. In addition to the requirements of this Section, import and/or exported materials shall comply with the requirements of Section 01 4524 - Environmental Import/Export Materials Testing.
- C. Imported fill materials will be sampled by the Geotechnical Engineer for compliance with the requirements of Part 2 of this Section.
- D. The geotechnical engineer will submit all samples to a DSA approved independent testing laboratory for testing.
- E. Initial sampling will be performed by the Geotechnical Engineer before importing material to the Project site. Identify the location of the source site in addition to the address, name of the person and/or entity responsible for the source site. The Geotechnical Engineer will obtain both the initial sample and additional samples from the identified site and will submit samples to the approved independent testing laboratory for testing.
- F. The Geotechnical Engineer will perform additional sampling during import operations. If the total quantity of import is determined to be greater than 1,000 cubic yards of material, one sample shall be obtained and submitted for testing for each 250 cubic yards of imported material. If the total quantity of import is determined to be less than

1,000 yards, one sample shall be obtained and submitted for testing for each 100 cubic yards of imported material.

- G. The independent approved testing laboratory will perform the required tests and report results of tests noting if the tested material passed or failed such tests and will furnish copies to the Project Inspector, ARCHITECT, OAR, DSA, CONTRACTOR, and others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, CBC and the DSA. Upon completion of the Work of this Section, the independent testing laboratory and Geotechnical Engineer will submit a verified report to the DSA as required by CBC.
- H. Bills of lading or equivalent documentation will be submitted to the Project Inspector on a daily basis.
- I. Upon completion of import operations, provide the OAR a certification statement attesting that all imported material has been obtained from the identified source site.

3.06 BACKFILLING

- A. After concrete has been placed, forms removed and concrete Work inspected, backfill excavations to indicated or required grades. Backfill simultaneously on each side of walls or grade beams. Remove rubbish, debris, and other waste materials from excavations before placing backfill.
- B. Before installing backfill, adequately cure concrete and provide bracing to stabilize structures. Protect waterproofing or dampproofing against damage during backfilling operations with required protection board. Remove bracing as backfill operation progresses.
- C. Do not furnish or install expansive soils for below grade building walls.
- D. Install each layer of material in a not to exceed thickness of 6 inches, unless otherwise required.
- E. Rigidly control the amount of water to be installed to provide optimum moisture content for type of fill material furnished. Do not over-saturate or compact by flooding or jetting.
- F. Install wall backfill before installing railings and fences on walls.
- G. Impervious backfill materials shall be installed in layers along with and by the same methods specified for structure backfill. Impervious backfill materials shall be at the approximate grade and elevation and where exposed to erosion, shall be covered with at least a 12-inch layer of fill material as reviewed by the Geotechnical Engineer.
- H. Install weep hole drainage at the backside of walls so the backing completely covers the weep holes, is horizontally centered and extends at least 12 inches above the bottom of the weep opening. Provide an 8-inch square section of 1/4 inch galvanized or aluminum screen, with a minimum wire diameter of 0.03 inch, and install at the backside of each weep hole before installing the backfill material.

- I. Where a reviewed drainage matting system is provided instead of permeable backfill for retaining structures, install in accordance with the manufacturer recommendations.

3.07 COMPACTING

- A. Compact each layer of fill material by tamping, sheepsfoot rollers or pneumatic-tired rollers, to such extent as to provide specified relative compaction. At inaccessible locations, compact to specified requirements with hand-held, operated and directed compaction equipment.
- A. Unless otherwise indicated, compact each layer of fill material to a relative compaction of at least 90 percent.
- B. Do not compact by flooding or jetting.
- C. When fill materials, or a combination of fill materials, are encountered or provided which develop densely packed surfaces as a result of installation or compacting operations, scarify each layer of compacted fill before installing the next succeeding layer.

3.08 INSPECTION AND TESTING

- A. The Geotechnical Engineer will inspect and test excavations, sample material quality as required in Part 2, and observe installation and compaction of fill materials.
- B. The Geotechnical Engineer will sample imported fill materials from their designated source before delivery to the Project site.
- C. Installation of backfill shall be observed by the Geotechnical Engineer.
- D. The Geotechnical Engineer will inspect and test excavation Work before the installation of fill and/or other materials.
- E. Compaction: Test compaction in accordance with ASTM D1557, Method C.
- F. The Project Inspector will inspect foundation excavations when completed and ready for forms, after forms are in place and before first placement of concrete.

3.09 PROTECTION

- A. Protect the Work of this Section until Substantial Completion.

3.10 CLEANUP

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 31 23 23

EXCAVATION AND FILL FOR UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Excavating, backfilling, and compacting utility trenches such as water, gas, irrigation, storm drain, sewer lines, concrete-encased conduits, and manholes, vaults, valve boxes, catch basins, underground tanks, thrust blocks, yard boxes, pull boxes and other utility appurtenances.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 01 4524 - Environmental Import/Export Materials Testing.
3. Section 31 1000 - Site Clearing.
4. Section 31 2200 - Grading.
5. Section 31 2316 - Excavation and Fill for Paving.
6. Section 31 2319 - Excavation and Fill for Structures.
7. Section 32 0117 - Pavement Repair.
8. Section 32 1313 - Site Concrete Work.
9. Section 32 8413 - Potable Water Irrigation.
10. Section 32 8426 - Reclaimed Water Irrigation.
11. Section 33 1100 - Site Water Distribution Utilities.
12. Section 33 3000 - Site Sanitary Sewer Utilities.
13. Section 33 4000 - Storm Drainage Utilities.
14. Division 22 - Plumbing.
15. Division 26 - Electrical.

1.02 PROJECT REQUIREMENTS

A. Import and Export of Earth Materials:

1. Fees: Pay as required by authorities having jurisdiction over the area.
2. Bonds: Post as required by authorities having jurisdiction over the area.
3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

1.03 QUALITY ASSURANCE

- A. Comply with the following as a minimum requirement: Standard Specifications for Public Works construction, current edition except as modified herein.
- B. Sampling, testing, and certification of imported and/or exported soils shall be performed in accordance with Section 01 4524 - Environmental Import/Export Materials Testing.

1.04 TESTING

- A. OWNER will retain a Geotechnical Engineer as an OWNER Consultant who will provide observations, tests, inspections and approvals identified in the Contract Documents as being responsibility of OWNER.
- B. Imported Soils: The Geotechnical Engineer will obtain initial product Sample for testing in accordance Article 3.02 of this Section.

1.05 PROJECT CONDITIONS

- A. Information on Drawings or in soils report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Bedding material from trench bottom to one foot above the pipe:
 1. Sand, gravel, crushed aggregate or native free-draining granular material providing a sand equivalent of at least 30 or a coefficient of permeability greater than 1.4 inches per hour.
 2. Sand complying with the Specifications for cement concrete aggregates.
- B. Backfill Materials:
 1. Excavated trench material to be installed for backfilling shall be clean, free of large clods, and stones larger than 2 ½-inch in any dimension.
 2. Cement-sand slurry shall be provided with one sack of cement per cubic yard of the mixture.
 3. Imported Fill Material: Imported fill material shall be a granular material with sufficient binder to form a firm and stable unyielding subgrade and

shall not have more than 60 percent of fines passing a 200 mesh sieve. Material shall provide a coefficient of expansion of not more than two percent from air dry to optimum moisture content and not more than six percent from air dry to saturation. Imported materials shall be clean and free of rubbish, debris, and toxic or hazardous contaminants. Adobe or clay soils are not permitted.

PART 3 - EXECUTION

3.01 GENERAL

- A. Before initiating intrusive activities, contact Underground Service Alert of Southern California (USA or Dig Alert) to obtain a Dig Alert ticket for location information on buried public and USA member utilities and pipelines at least 48-hours prior to beginning work. A copy of the Dig Alert ticket shall be forwarded to the OWNER. For on-site utilities, retain a state-licensed third party underground utility locating service.
- B. Barricade trenches, ditches, pits, sumps, and similar Work outside the barricaded working area with chain link fence as specified in Section 01 5000, Construction Facilities and Temporary Controls, and in accordance with Cal-OSHA standards and requirements.
- C. Saw-cut concrete or bituminous paving for trench installation.
- D. Trenches over 5 feet in depth shall conform to the Cal-OSHA.
- E. Where indicated and required to excavate in lawn areas, protect adjoining lawn areas outside of the Work area. Replace or install removed sod upon completion of backfill by installing sod level with adjacent lawns. If installation of removed sod fails, furnish sod and install to match existing lawns.
- F. Backfill over excavations to the required elevations with earth, gravel, sand, or concrete and compact as required. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. Slope adjacent grades away from excavations to minimize entry of water.
- G. Do not install piping lengthwise under concrete walks without review by the ARCHITECT.
- H. Do not excavate trenches parallel to footings closer than 18 inches from the face of the footing or below a plane having a downward slope of two horizontal to one vertical, from a line 9 inches above bottom of footings.
 - 1. Unless otherwise indicated on Drawings, depth of excavations outside the buildings shall allow for a minimum coverage above top of pipe, tank, or conduit measured from the lowest adjoining finished grade, as follows:

Steel Pipe	24 inches below finished grade
Copper Water Tube	18 inches below finished grade
Cast-Iron Pressure Pipe	36 inches below finished grade

Plastic Pipe (other than waste)	30 inches below finished grade
Tanks or other structures	36 inches below finished grade
Soil, Sewer & Storm Drain	minimum 18 inches below finished grade, and as required for proper pitch and traffic load. (Install polypropylene sewer pipe with at least 24 inches coverage)
Irrigation Pipe:	nonpressure pipe 12 inches, pressure pipe 24 inches

2. Trench width shall provide ample space for fitting and joining. Excavate for piping bells and fittings, bell and spigot pipe and other fittings.
- I. Unless indicated otherwise, excavate trenches to the required depths for utilities, such as pipes, conduit and tanks, with minimum allowances of 6 inches at the bottom and 6 inches at the sides for bedding of unprotected piping or as required for concrete encasement of conduits as indicated on Drawings. Grade bottom of trenches to a uniform smooth surface. Remove loose soil from the excavation before installing sand bedding or concrete encasement.
- J. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. If soil becomes soft, soggy, or saturated, excavate to firm undisturbed soil and fill as required. Slope adjacent grades away from excavations to minimize entry of water.
- K. Provide a minimum clear dimension of 2 inches from sides of wall excavation to outer surfaces of buried pipes or conduits installed in the same trench or outside surfaces of containers and tanks.
- L. Do not install backfill until required inspections and testing is completed.
- M. Backfill electrical or other excavated utility trenches located outside of barricaded installation areas within 24 hours after inspection by the Project Inspector.
- N. Install backfill materials in layers not exceeding 4 inches in thickness and compact to 90 percent of the maximum density.
- O. If materials excavated from the Project site are not permitted for trench backfill in paved areas, backfill trenches with a cement-sand slurry mix. Install backfill to an elevation of the existing undisturbed grade plus one inch.
- P. Install and compact sand bedding to provide a uniform full length bearing under piping and conduits.
- Q. Where portions of existing structures, walks, paving, or other improvements are removed or cut for piping or conduit installation, replace the material with equal quality, finished to match adjoining existing improvements. Repair pavement as specified in Section 32 0117, Pavement Repair.

3.02 IMPORT/EXPORT OF MATERIALS

- A. Provide fill materials as specified in Part 2, Products. If excavated materials from the Project site are not of required quality or sufficient quantity, import additional materials as necessary.
- B. In addition to the requirements of this Section, import and exported materials shall comply with the requirements of Section 01 4524, Environmental Import/Export Material Testing.
- C. Imported fill materials will be sampled by the Geotechnical Engineer for compliance with the requirements of Part 2 of this Section.
- D. The Geotechnical Engineer will perform the tests by utilizing an independent approved testing laboratory.
- E. Initial sampling will be performed by the Geotechnical Engineer before importing material to the Project site. Identify the location of the source site in addition to the address, name of the person and/or entity responsible for the source site. The Geotechnical Engineer will obtain both the initial sample and additional samples from the identified site and shall submit all samples to the approved independent testing laboratory.
- F. The Geotechnical Engineer will perform additional sampling during import operations. If the total quantity of import is determined to be greater than 1,000 cubic yards of material, one sample shall be obtained and submitted for testing for each 250 cubic yards of imported material. If the total quantity of import is determined to be less than 1,000 yards, one sample shall be obtained and submitted for testing for each 100 cubic yards of imported material.
- G. The independent approved testing laboratory will perform the required tests and report results of all tests noting if the tested material passed or failed such tests and will furnish copies to the Project Inspector, ARCHITECT, OAR, DSA, CONTRACTOR, and others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, CBC and the DSA. Upon completion of the Work of this Section, the independent testing laboratory and Geotechnical Engineer will submit a verified report to the DSA as required by CBC.
- H. Bills of lading or equivalent documentation will be submitted to the Project Inspector on a daily basis.
- I. Upon completion of import operations, provide the OAR a certification statement attesting that imported material has been obtained from the identified source site.

3.03 INSPECTION AND TESTING

- A. The Geotechnical Engineer will inspect and test excavations, sample material quality as required in Part 2, observe installation and compaction of fill materials.
- B. Compaction test shall be performed in accordance with ASTM D1557, method "C."

3.04 PROTECTION

- A. Protect the Work of this Section until Substantial Completion.

3.05 CLEANUP

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 31 23 26

BASE COURSE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Installation of base material.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 01 4524 – Environmental Import / Export Material Testing.
2. Section 31 1000 - Site Clearing.
3. Section 31 2200 - Grading.
4. Section 31 2313 - Excavation and Fill.
5. Section 31 2316 - Excavation and Fill for Paving.
6. Section 32 0117 - Pavement Repair.
7. Section 32 1216 - Asphalt Paving.
8. Section 32 1313 - Site Concrete Work.

1.02 SUBMITTALS

- A. Crushed aggregate base (CAB) shall consist of native rock without naturally occurring asbestos or recycled materials. The CONTRACTOR shall submit written documentation, which identifies the source, volume, and proposed transport date of the material for review and approval by OWNER'S Office of Environmental Health and Safety (OEHS) prior to importing the material. A statement on company letterhead from the CAB source, stamped by either a California Professional Geologist or Engineer, which states that the subject materials are native rock, do not contain any recycled materials and that the source quarry does not mine ultramafic materials, a source of natural occurring asbestos shall be included in the submittal to OEHS. The CONTRACTOR may request variance from analytical testing required by Section 01 4524 for CAB. To be considered for a variance, the CONTRACTOR shall submit a documentation package for OEHS approval, which includes all of the aforementioned information at least 48 hours in advance of planned import.

1. Frequently used suppliers for LAUSD projects include:
 - a. Hansen Aggregates.

- b. Vulcan Materials, Reliance Company.
- c. Vulcan Materials Durbin.
- C. Product Data: Submit material source, technical information and test data for base materials. Gradation and quality certifications shall be dated within 30 days of the submittal.
- D. Sample: Submit sample of proposed base course material.

1.03 QUALITY ASSURANCE

- A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction, current edition.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Crushed Aggregate Base (CAB) materials shall conform to the requirements of the Standard Specifications for Public Works Construction: Section 200 - Rock Materials.
- B. Crushed Miscellaneous Base (CMB) or materials generated on site shall not be used as a base course material.

2.02 MATERIAL APPROVAL

- A. Base material shall be inspected by the Project Inspector for gradation and material content prior to installation. The OWNER may choose to have additional tests performed by a geotechnical engineer, retained by the OWNER, before installation.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install base course material in layers not exceeding 4 inches in thickness, unless required otherwise. Grade and compact to indicated levels or grades, cut and fill, water and roll until the surface is hard and true to line, grade and required section. Provide a relative compaction of at least 90 percent, unless otherwise required.
- B. Grade base course to elevations indicated on Drawings, ready to receive surfacing, in accordance with Section 31 2200 - Grading.

3.02 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

3.03 CLEANUP

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 31 31 19

VEGETATION CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Application of soil sterilant on subgrades for roadways, driveways, parking areas, walks, paths, trails and any other site improvements called for on the plans.

1.2 RELATED DOCUMENTS

- A. CAL/OSHA, Title 8.

1.3 SUBMITTALS

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.

PART 2 - PRODUCTS

2.1 SECTION INCLUDES

- A. Commercial chemical for weed control, registered by EPA. Provide granular, liquid or wet-able powder form.

PART 3 - EXECUTION

3.1 SOIL STERILIZATION

- A. Apply soil sterilant to areas indicated, such as beneath asphalt concrete pavement, brick pavement, concrete pavement and at grade concrete slabs, including sidewalks, curbs and gutters. Also, where indicated apply soil sterilant below expansion and control joints and at areas where pipes, ducts or other features penetrate slabs.
- B. Apply soil sterilant uniformly and at the rates recommended by the manufacturer.
- C. Apply soil sterilant to prepared subgrade, or after installation of aggregate base as recommended by the manufacturer.

3.2 DISPOSAL

- A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the Owner.

END OF SECTION

SECTION 32 01 90

OPERATION AND MAINTENANCE

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Specified in this Section: Furnish all labor, material, equipment, and services required to maintain the landscape in an attractive condition as specified herein for a period of 90 calendar days.
- B. Definition: The word Architect as used herein shall refer to the Landscape Architect or the Owner's authorized representative.

1.2 QUALITY ASSURANCE

- A. The Contractor's representatives and employees shall be experienced in landscape maintenance.

1.3 90 CALENDAR DAY MAINTENANCE PERIOD

- A. The Contractor shall continuously maintain all areas involved in this Contract during the progress of work. Maintenance period shall not start until all elements of construction, planting, and irrigation for the entire project are in accordance with Plans and specifications.
 - 1. A prime requirement is that all lawn and groundcover areas shall have been planted and that all lawn areas shall show an even, healthy stand of grass seedlings or sod, either of which shall have been mowed twice. Maintenance period will not be shortened when these criteria is met but may be lengthened if not met.
 - 2. The Contractor's maintenance period will be extended if the provisions required within the Plans and specifications are not fulfilled. Project may not be segmented into maintenance phases.
 - 3. The Contractor shall request a Pre-Maintenance inspection by the Owner and Architect at the completion of the installation process.
 - 4. The Maintenance Period shall begin upon successful completion of the Pre-Maintenance walk-through punch list and acceptance of the landscape installation by the Owner.
 - 5. If such criteria are met to the satisfaction of the Owner, a field notification will be issued to the Contractor to establish the effective beginning date of the maintenance period.
- B. The Maintenance Period continues for 90 calendar days until final acceptance of the work by the Owner. Improper maintenance or poor condition of planting at the

termination of the scheduled maintenance period shall cause postponement of the final completion date of the Contract.

- C. Any day when the Contractor fails to adequately maintain planting, replace unsuitable plants or do weed control or other work, as determined necessary by the Owner, will not be credited as one of the maintenance periods working days.

1.4 GUARANTEE AND REPLACEMENT

- A. Guarantee: All plant material installed under the contract shall be guaranteed for a period of one year. Plants found to be dead or in poor condition due to faulty materials or workmanship, as determined solely by the Architect, shall be replaced by the Contractor at their expense.
 - 1. Replacement: Materials found to be dead, missing, or in poor condition during the Maintenance period shall be replaced immediately.
 - 2. The Architect shall be the sole judge as to the condition of material.
 - 3. The Contractor shall replace material rejected during the Guarantee period within fifteen (15) days of written notification by the Owner.

1.6 OBSERVATION VISITS

- A. The Contractor shall request progress visits from the Architect at least 48 hours in advance of anticipated visits. Normal observation visits are as follows:
 - 1. Immediately prior to the commencement of the work in this section.
 - 2. Completion of first 90 days of maintenance.
 - 3. Final acceptance.
- B. Fabricator Qualifications: Firm experienced in successfully producing metal fabrications similar to that shown on the drawings, with sufficient production capacity to produce required units without causing delay in the work.
- C. Qualify welding processes and welding operators in accordance with AWS D1.1 and D1.3. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- D. All materials used shall be free of lead and asbestos fibers.

1.7 OBSERVATION VISITS

- A. Prior to the date of the final observation visit, the Contractor shall acquire from the Architect-approved reproducible Plans and record (from the job record set) all changes made during construction, label these Plans "Record Drawings", and deliver to the Architect for review and approval.
- B. Prior to the date of final inspection, the Contractor shall deliver to the Architect a written "Landscape and Irrigation Guarantee" as required herein 1.6.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All materials used shall either conform to landscape specifications in other sections or shall otherwise be acceptable to the Owner.
- B. The Owner shall be given a monthly record of all herbicides, insecticides, and disease control chemicals used. Failure to provide such a record will continue maintenance period until compliance occurs.

PART 3 - EXECUTION

3.1 MAINTENANCE

- A. Maintenance shall be performed according to the following standards:
 - 1. All areas shall be weeded and cultivated at intervals of not more than ten (10) days.
 - 2. Watering, mowing, rolling, edging, trimming, fertilization, spraying, and pest and rodent control, as may be required, shall be included in the maintenance period.
 - 3. Street gutters shall be cleaned as part of the maintenance program.
 - 4. The Contractor shall be responsible for maintaining adequate protection of the area.
 - a. Damaged areas shall be repaired at the Contractor's expense.
 - 5. Between the 15th day and the 20th day of the maintenance period, the Contractor shall reseed and re-sod all spots or areas within the lawn where normal turf growth is not evident.
- B. The Contractor shall be responsible for reporting to the Owner conditions beyond his control that prevent or have negative impact on the work required herein.

3.2 TREE AND SHRUB CARE

- A. Watering
 - 1. Apply enough irrigation water so that moisture penetrates throughout root zone and only as frequently as necessary to maintain healthy growth.
 - a. Do not maintain soils in a constantly wet condition.
 - b. Contractor shall be responsible for familiarizing himself with the water requirements for the various plantings and shall be responsible for setting and maintaining the automatic controller to optimum minimum levels.

- c. Damage to the plantings caused by over-watering or under-watering shall be the responsibility of the Contractor to replace at no cost to Owner.
2. Maintain a water basin around newly planted plants so that water can be applied to moisturize throughout the root zone. At the end of the maintenance period these basins shall be flattened out to match surrounding grades.
3. If hand-watering, use a fan spray nozzle to break the water force.

B. Tree Pruning

1. Nursery grown trees will not normally require pruning for the first year. Prune trees only if directed by Architect or Owner, and only for these purposes:
 - a. selection and development of permanent scaffold branches that have a vertical spacing of from 18" to 48" and radial orientation so as not to cross each other,
 - b. elimination of diseased or damaged growth,
 - c. elimination of narrow V-shaped branch forks that lack strength,
 - d. reduction of toppling and wind damage by thinning out crowns,
 - e. maintenance of growth within space limitations,
 - f. maintenance of natural appearance,
 - g. Balancing of crown-to-root ratio.
2. Under no circumstances will stripping of lower branches ("rising up") of young trees be permitted.
 - a. Lower branches shall be retained in a "tipped-back" or pinched condition with as much foliage as possible to promote caliper trunk growth (tapered trunk).
 - b. Lower branches can be cut flush with trunk only after the tree is able to stand erect without staking or other support.
3. Evergreen trees shall be thinned out and shaped when necessary to prevent wind and storm damage. The primary pruning of deciduous trees shall be done during the dormant season. Damaged trees or those that constitute health or safety hazards shall be pruned at any time of the year as required.

C. Shrub Pruning

1. The objectives of shrub pruning are the same as for trees. Shrubs shall not be clipped into balled or boxed forms unless such is required by the design.
2. All pruning cuts shall be made to lateral branches or buds or flush with the trunk. "Stubbing" will not be permitted.

- D. Staking and Guying: Stakes and guys shall remain in place until final acceptance and are to be continuously inspected and adjusted to prevent girdling of trunks or branches and to prevent rubbing that causes bark wounds and to allow trees to sway freely. Stakes and guys are to be removed when trees become sufficiently well rooted or after one year. When stakes or guys are removed, tree heads may be thinned to reduce wind load.
- E. Weed Control: Keep all areas, including basins and areas between plants, free of weeds.
 - 1. Use recommended legally approved herbicides only when mechanical removal methods are not feasible.
 - 2. Avoid frequent soil cultivation next to trees or shrubs that destroys shallow roots.
 - 3. Use mulches to help prevent weed seed germination.
- F. Pest and Disease Control: Maintain control of insect and rodent infestations. The preferred method of control shall be biological control, or with non-toxic, biodegradable, organic materials. If stronger materials are needed, only materials that are recommended by a licensed Pest Control Advisor and are EPA approved and regulated shall be used. Only registered and licensed Pest Control Operators shall apply insecticide or chemical applications. Notify Owner a minimum of five (5) working days before chemical applications.
- G. Fertilization.
 - 1. Fertilize all planting areas at 30-day intervals, with fertilizer and at rate as recommended by Soils Report.
 - a. Avoid applying fertilizer to root balls and bases of main stems
 - b. Spread fertilizer evenly around plants to drip line.
 - c. Distribute fertilizer evenly over turf or groundcover areas to avoid patchy coloration.
 - d. Replacement of Plants: Replace dead, dying, and missing plants with plants of a size, condition, and variety acceptable to Architect or Owner at Contractor's expense.

3.3 GROUND COVER CARE

- A. Weed Control: Control weeds preferably with mechanical methods, and with preemergent herbicides and selective systemic herbicides. Hoe weeds as little as possible since this may result in plant damage. Foot traffic in planted areas shall be minimized, and soil compaction shall be loosened immediately.
- B. Watering: Water enough so that moisture penetrates throughout root zone and only as frequently as necessary to maintain healthy growth.
 - 1. Do not maintain soils in a constantly wet condition.

2. Contractor shall familiarize himself with the particular water requirements for the planting and shall be responsible for setting and maintaining the automatic controller to optimum minimum levels.
 3. Damage to the planting caused by over-watering or under-watering shall be the responsibility of the Contractor to replace.
- C. Trash: Remove trash weekly. Remove debris, clippings or branches produced by maintenance activities within 8 hours.
 - D. Edging and Trimming: Edge ground cover to keep in bounds and trim top growth as necessary to achieve an overall even appearance.
 - E. Replacement: Replace dead and missing plants at Contractor's expense.

3.4 IRRIGATION SYSTEM

- A. System Inspection: Contractor shall continuously check all systems for proper operation. Lateral lines shall be flushed out after removing the last sprinkler head or two at each of the lateral. All heads are to be continuously adjusted as necessary for proper coverage and to eliminate over-spray on buildings or paving. Contractors regular maintenance personnel shall test, observe, and adjust each sprinkler system no less than once per month.
- B. Controllers: Set and program automatic controllers for seasonal water requirements and minimum optimum water use. Give Owner's representative a key to controllers and instructions on how to turn off system in case of emergency.
- C. Repairs: Repair all damage to irrigation system at Contractor's expense. Repairs shall be made within one watering period.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Paving for playground, parking areas, areas between buildings surfacing adjacent to planting and turf areas as indicated.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 31 2200 - Grading.
3. Section 32 0117 - Pavement Repair.
4. Section 31 2326 - Base Course.
5. Section 32 1219 – Asphalt Paving for Running Track Surfacing.
6. Section 32 1236 - Seal for Bituminous Surfacing.
7. Section 32 1313 - Site Concrete Work.

1.02 SUBMITTALS

- A. Shop Drawings: Submit site plan indicating extent of paving and accessories.
- B. Product Data: Manufacturer's technical data for materials and products.

1.03 QUALITY ASSURANCE

- A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction.
- B. ADA related slopes shall be measured with a twenty-four-inch digital level.

1.04 PROJECT CONDITIONS

- A. Information on Drawings or in soils report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.

- B. A copy of the soils report is available for examination in the office of the ARCHITECT during regular office hours of the ARCHITECT.

PART 2 - PRODUCTS

2.01 BITUMINOUS MATERIALS

- A. Provide materials of the class, grade, or type indicated on the Drawings, conforming to relevant provisions of Section 203 - Bituminous Materials of the Standard Specifications for Public Works Construction.
- B. Asphalt Concrete Mix:
 - 1. Paved slopes: Type III, D, PG-64-10.
 - 2. Between buildings, playgrounds, parking and fire lanes: Type III, C3, PG-64-10.
 - 3. Driveways for trash and delivery trucks: Type III, C3, PG-64-10 and Type III, B3, PG-64-10

PART 3 - EXECUTION

3.01 HEADERS

- A. Concrete Headers:
 - 1. Install headers along edge of bituminous surfacing as indicated on the Drawings.
 - 2. Verify that gradients and elevations of base are correct. Maintain subgrade clean and in a smooth, compacted condition until the concrete is placed.
 - 3. Construct forms, install steel reinforcement and place concrete as indicated on Section 32 1313 Site Concrete.

3.02 CONSTRUCTION OF ASPHALT CONCRETE PAVEMENT

- A. Pavement Thickness: Unless otherwise indicated on Drawings or specified, install bituminous surfacing to a compacted thickness of 2 inches.
- B. Base course shall be as specified in Section 31 2326, Base Course.
- C. Surfaces of walls, concrete, masonry, or existing bituminous surfacing indicated to be in direct contact with installed bituminous surfacing shall be cleaned, dried and uniformly coated with an asphaltic emulsion film.

- D. Thicken edges of bituminous surfacing that do not abut walls, concrete, or masonry, and at edges joining existing bituminous surfaces. Remove headers at existing bituminous surfacing where new bituminous surfacing is to be installed. Thicken edges an additional 2 inches and taper to the indicated or specified thickness 6 inches back from such edges.
- E. At stairways, adjust thickness of paving such that the first tread is equal in height to all other treads.
- F. Provide adequate protection for concrete, planting areas, and other finish Work adjacent to areas indicated to receive bituminous surfacing.
- G. Placing:
 - 1. Do not install bituminous surfacing when atmospheric temperature is below 40 degrees F; or when fog or other unsuitable weather conditions are present. Temperature of mixture at time of installation shall not be lower than 260 degrees F in warm weather or higher than 320 degrees F in cold weather.
 - 2. Where 2-inch or 3-inch thick surfacing is indicated or specified, install surfacing in one course. Where surfacing is indicated or specified 4 inches or more in thickness, except for thickened edges, install bituminous surfacing in courses of approximately equal thickness, each course not exceeding 2 ½ inches in thickness.
- H. Stakes or Screeds: Provide grade or screed stakes spaced not more than 15 feet apart in flow lines with grades of less than one percent. Continuous screeds may be provided instead of stakes.
- I. Spreading: Install bituminous surfacing in a manner to cause least possible handling of mixture. In open areas and wherever practicable, install by mechanical means with a self-propelled mechanical spreader. In confined or restricted areas, install mixture with hot shovels and rakes, and smooth with lutes.
- J. Joints: Provide vertical joints between successive runs. Install joints true to line, grade, and cross section. Lapped joints are not permitted.
- K. Rolling:
 - 1. Finish roll with a self-propelled tandem roller weighing at least 8 tons. Break down roll with a self-propelled roller weighing between 1 ½ tons and 8 tons.
 - 2. Roll in a manner that preserves flow lines and the established finished grades. Break down roll in areas adjacent to flow lines parallel to flow lines. Break down roll after bituminous surfacing is installed without shoving or cracking of mixture under roller. Continue finish rolling until surfacing is unyielding, true to grade, and meets requirements for specified smoothness. Areas inaccessible to finish roller may be finish rolled with breakdown roller or tamped with hot tamping irons and smoothed with hot smoothing irons, hand roller or asphalt plate compactor.

3. Where bituminous surfacing abuts concrete, masonry, walks or paving, tamp joint smooth, if necessary, as described above to obtain a uniformly even joint, true to line and grade. Tamp and smooth to properly compact.
 4. Compacted bituminous surfacing shall be provided with a bulk specific gravity of at least 2.31 when tested in accordance with ASTM D1188.
- L. Allow bituminous surfacing a thirty day curing time before applying surface seal.

3.03 TOLERANCE

- A. Smoothness: Surface of bituminous surfacing after rolling, shall be even, smooth and uniform in texture with no voids or rock pockets, free of roller marks or other irregularities, and not varying by more than 0.03 foot, except at local depressions or raised areas as indicated, when a 10-foot straightedge is placed on surface.
- B. Grade: Finished grade shall not vary more than 0.02 foot above or below required grade. Variations within prescribed tolerance shall be compensating so that average grade and cross-section are provided.

3.04 TESTING

- A. Asphalt Pavement to Receive Solar Reflective Coating:
1. After asphalt paving has been installed and after a 24 hour period, flood test entire area in presence of the Project Inspector. Inspect area after waiting one hour. Entire area tested shall be free of standing water or puddles in excess of 0.01 foot. Practical field measurement 0.01 foot = two quarters stacked. Repair areas of standing water or puddles and flood test locally; install surface seal and retest as necessary.
 2. No seals are to be applied to areas of asphalt paving that are to receive solar reflective coatings.
- B. Asphalt Pavement to Receive Bituminous Seal: refer to Section 32 1236 Seal for Bituminous Surfacing.

3.05 PROTECTION

- A. Protect the Work of this section until Substantial Completion

3.05 CLEANUP

- A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 32 12 36

SEAL FOR BITUMINOUS SURFACING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Surface sealer over bituminous surfacing.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 32 0117 - Pavement Repair.
3. Section 32 1216 - Asphalt Paving.
4. Section 32 1723 - Pavement Marking.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's product information and application procedures for bituminous surfacing.

1.03 QUALITY ASSURANCE

- A. Comply with the Standard Specifications for Public Works Construction, current edition.
- B. Agitate bulk materials during transport.

1.04 MAINTENANCE

- A. Extra Materials: Provide 10 gallons in unopened containers.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Provide one of the following surface seals:

Product Name

Manufacturer

1. Guard-Top CALMAT / Industrial Asphalt

2.	Over Kote	Diversified Asphalt Product
3.	Park Top	Western Colloid Products
4.	Sure Seal	Asphalt Coating Engineering
5.	Super Drive Top.	SAF— T Seal. Inc.
6.	Equal.	

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

- A. Thoroughly wash surfaces with water to remove dirt, debris, excessive oil and grease, or other foreign matter.

3.02 APPLICATION

- A. Install seal coat in strict accordance with manufacturer's written directions and recommendations.
- B. Install two coats of surface seal to new bituminous surfacing. First coat shall be installed before flood testing. Clean surface and allow to dry before installing second coat. Second coat shall be installed after bituminous surfacing has passed flood test.
- C. Where new bituminous surfacing is installed adjacent to existing bituminous surfacing, overlap surface seal a minimum of 12 inches onto existing bituminous surfacing.
- D. Where existing bituminous surfacing is indicated to be patched and sealed, install two coats of surface seal after patching. Refer to Section 32 1216 - Asphalt Paving.

3.03 PROTECTION OF SURFACES

- A. Protect sealed and unsealed surfaces from damage and traffic during performance of the Work of this section and until surface seal has thoroughly set and cured. Do not permit traffic of any kind for at least 24 hours after completion of installation.
- B. Protect the Work of this section until Substantial Completion.

3.04 TESTING

- A. OWNER reserves the right to obtain samples, perform tests to ensure compliance with the Specifications, and to review weight slips and invoices of materials delivered to the Project site.
- B. After first coat of surface seal has been installed and after a 24-hour period, flood test entire area in presence of the Project Inspector. Inspect area after waiting one hour. Entire area tested shall be free of standing water or puddles in excess of 0.01 foot.

Practical field measurement: 0.01 foot = two quarters stacked. Repair areas of standing water or puddles and flood test locally; install surface seal and retest as necessary.

3.05 CLEAN UP

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 32 13 13

SITE CONCRETE WORK

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: On-site concrete work:

1. Portland cement concrete pavement, driveways, curbs, gutters and mowing strips.
2. Ramps and stairs on grade.
3. Footings for fence posts, bollards, flagpoles, shade structures, light standards and athletic and playground equipment.
4. Pipe encasements, thrust blocks, and equipment pads.
5. Retaining walls, planter walls and concrete benches.
6. Skateboard deterrents.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 03 1000 – Concrete Forming and Accessories.
3. Section 03 2000 - Concrete Reinforcement.
4. Section 03 3000 – Cast-in-Place Concrete.
5. Section 07 9200 – Joint Sealants.
6. Division 23 - HVAC.
7. Division 26 - Electrical.
8. Section 31 2200 – Grading.
9. Section 31 2316 - Excavation and Fill for Pavement.
10. Section 31 2319 – Excavation and Fill for Structures.
11. Section 31 2326 - Base Course.
12. Section 32 1723 – Pavement Markings.

13. Section 32 3113 - Chain Link Fences and Gates.
14. Section 33 1100 - Site Water Distribution Utilities.
15. Section 33 3000 - Site Sanitary Sewer Utilities.
16. Section 33 4000 - Storm Drainage Utilities.

1.02 REFERENCES

- A. Structural work, such as retaining walls, planter walls, cast-in-place benches, equipment pads, and footings for playground equipment, fences, walls, shade structures and flagpoles shall conform to the following Sections:
 1. Section 03 1000 Concrete Forming.
 2. Section 03 2000 Concrete Reinforcing.
 3. Section 03 3000 Cast-in-Place Concrete.
- B. Flatwork, such as walkways, driveways, ramps and steps on grade, swales, curbs, mow strips and utility related concrete, conform to:
 1. Standard Specifications for Public Works Construction, The "Greenbook", except reclaimed aggregates and processed miscellaneous base are not allowed.
- C. Imported or exported earthwork shall conform to Section 01 4524 Environmental Import / Export Materials Testing.
- D. National Ready Mixed Concrete Association (NRMCA):
 1. Checklist for the Concrete Pre-Construction Conference.

1.03 QUALITY ASSURANCE

- A. Source Limitations for Exposed Concrete: Obtain each color, size, type, and variety of concrete material and concrete mixture from single manufacturer with resources to provide concrete of consistent quality in appearance and physical properties. Secure material required for the duration of the project as needed to ensure consistent quality in appearance.
- B. Pre-Installation Conference:
 1. CONTRACTOR shall coordinate and conduct pre-installation conference in conformance to Section 01 3119 Project Meetings.
 2. CONTRACTOR shall use the NRMCA "Checklist for the Concrete Pre-Construction Conference" as the meeting agenda.
- C. Mockup:

1. Build 8 feet by 8 feet mockups of full-thickness sections of concrete paving using processes and techniques intended for use on permanent work, including curing procedures.
 2. Build mockups to demonstrate typical joints; surface finishes and standard of workmanship.
 3. Obtain ARCHITECT's approval of mockup before proceeding with work of this Section.
 4. Mockup shall remain through completion of the work for use as a quality standard for finished work.
 5. Remove mockup when directed by the OAR.
- D. Field applied primers, paintings, sealers, sealants, caulking, leveling and patching compounds, crack/joint repair compounds adhesives and similar products shall be approved by the OWNER's Office of Environmental Health and Safety (OEHS).
- E. ADA related slopes shall be measured with a twenty-four-inch digital level.

1.04 SUBMITTALS

- A. Structural Work: Conform to the applicable requirements of Sections 03 1000 Concrete Forming, 03 2000 Concrete Reinforcing and 03 3000 Cast-in-Place Concrete.
- B. Flatwork: Submit mix design in conformance to the Greenbook.
- C. Shop Drawings: Submit drawings indicating the locations of concrete joints, including construction joints, expansion joints, isolation joints, and contraction joints.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Store cement and aggregate materials so to prevent their deterioration or intrusion by foreign matter. Deteriorated or contaminated materials shall not be furnished.
- B. Packaged materials shall bear the manufacturers and brand name label and shall be stored in their original unbroken package in a weather tight place until ready for use in the work.
- C. Avoid exposure of reinforcing steel bars, wire, and wire fabric to dirt, moisture or conditions harmful to reinforcing.
- D. Reinforcing steel bars, wire, and wire fabric shall be stored on the Project site to permit easy access for examination and identification of each shipment. Material of each shipment shall be separated by size and shape.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Structural Work: Conform to the applicable requirements of the following Sections, except as otherwise specified:
 - 1. Section 03 1000 Concrete Forming.
 - 2. Section 03 2000 Concrete Reinforcing.
 - 3. Section 03 3000 Cast-in-Place Concrete.
 - 4. Section 07 9200 Joint Sealants.
- B. Flatwork: Conform to the applicable requirements of the Greenbook, Section 201, except as follows:
 - 1. Water/cement ratio for concrete flatwork shall be 0.50 maximum.
 - 2. Base course shall conform to Section 32 3226 Base Course.
 - 3. Reclaimed concrete material shall not be used.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that gradients and elevations of base are correct. Maintain subgrade clean and in a smooth, compacted condition until the concrete is placed.
- B. Maintain subgrade in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. Earth surface shall be kept moist by frequent sprinkling up to the time of placing concrete.

3.02 CONSTRUCTION OF FORMS

- A. Flatwork Forming: Set forms to the indicated alignment, grade and dimensions. Hold forms rigidly in place by a minimum of 4 stakes per form placed at intervals not to exceed two feet. Use additional stakes and braces at corners, deep sections, and radius bends, as required. Use clamps, spreaders, and braces where required to ensure rigidity in the forms.
- B. Wall Formwork: Forms shall be constructed to conform to final concrete shape, lines and dimensions of members required by Drawings and Specifications. Forms shall be sufficiently tight to prevent leakage of concrete and properly braced or tied together to maintain position and shape.

3.03 STEEL REINFORCEMENT INSTALLATION

- A. Fabricate bars of the indicated sizes and bend and form to required shapes and lengths by methods not injurious to materials. Do not heat reinforcement for bending. Bend bars No. 6 size and larger in the shop only. Bars with unscheduled kinks or bends are not permitted.
- B. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- C. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces, and lace splices with wire.
- D. Clean reinforcement of loose rust and mill scale, earth, or bond-reducing materials.

3.04 PREPARATION FOR CONCRETE PLACEMENT

- A. Surfaces to receive concrete shall be free of debris, standing water, and any other deleterious substances before start of concrete placing.
- B. Do not place concrete until forms, reinforcement, pipe, conduits, outlet boxes, anchors, sleeves, bolts, and other embedded materials are securely fastened in place. Maintain a minimum of two inches clearance between said items and any part of the concrete reinforcement.
- C. Adjust pull boxes, meter boxes, valve covers and manholes to proposed finish grade prior to placement of concrete. Anchor bolts shall be accurately set and maintained in position by templates while being embedded in concrete.
- D. Clean thoroughly the surfaces of metalwork to be in contact with concrete, remove dirt, grease, loose scale and rust, grout, mortar, and other foreign substances before the concrete is placed.
- E. Moisten subbase to provide a uniform dampened condition at time concrete is placed.

3.05 CONCRETE PLACEMENT

- A. Place, compact, screed, float and trowel concrete as indicated in Section 03 3000 Cast-in-Place Concrete.
- B. Finish: After straightedging, when most of the water sheen has disappeared and just before the concrete hardens, finish the surface with a wood or magnesium float or darby to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. Produce a scored surface by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, followed by edging.
 - 1. Provide medium broom finish on surfaces up to six percent slope by striating surface 1/32 to 3/64 inch deep with a soft bristle broom across concrete surface to provide a uniform fine line texture.
 - 2. Provide heavy broom finish on surfaces over six percent by striating surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom.

3.06 JOINTS

- A. Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated. Align curb, gutter, and sidewalk joints.
- B. Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour.
 - 1. Continue steel reinforcement across construction joints unless otherwise indicated on the Drawings.
 - 2. Provide tie bars at sides of paving strips where indicated on the Drawings
 - 3. Butt Joints: Use bonding agent or epoxy-bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
 - 5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated on the Drawings.
- D. Expansion Joints:
 - 1. Provide premolded joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together. Extend expansion joint fillers full-width and depth of joint, and 1/4" below finished surface where joint filler is indicated. If no joint sealer is indicated place top of premolded joint filler flush with top of concrete or curb.
 - 2. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- E. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints to a depth equal to at least one-fourth of the concrete thickness, as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Remove grooving-tool marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
 3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- F. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Remove edging-tool marks on concrete surfaces.
- G. Where concrete is to be cast against old concrete, (greater than 60 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by sand-blasting, exposing the aggregate. The hardened surface shall be cleaned of latent foreign material and washed clean, prior to the application of an epoxy bonding agent.

3.07 STAIRS AND RAMPS

- A. Install support post sleeves into the perimeter concrete curbing during the installation process of the curbing. Sleeves shall be three-inch diameter, schedule 40 PVC with a cap solvent welded to the bottom of the sleeve. Drill a half-inch weep hole on the bottom of the cap. Sleeve and cap shall be Nibco products or approved equal. Sleeves shall be embedded into concrete a minimum of nine inches and spaced at a maximum of four feet, or as indicated on the Drawings. Fill sleeve with non-shrink grout Quickcrete #1585-01 when setting posts. Provide control joints into the concrete on both sides for each post.
- B. Finish step nosings with a safety step edger/groover with a 1/2 inch radius and four grooves spaced equally 3/4 inch on center and a bit depth between 1/4 to 3/8 inch. Paint with contrasting color.

3.08 CURB AND GUTTER CONCRETE PLACEMENT AND FINISHING

- A. Formed Curb and Gutter: Place concrete to the required section in a single lift. Consolidate concrete using approved mechanical vibrators. Finish curve shaped gutters with a standard curb mule or concrete slipformed curb paving equipment.
- B. Concrete Finishing: Float and finish exposed surfaces with a smooth wood float until true to grade and section and uniform in texture. Brush floated surfaces with a fine-hair brush using longitudinal strokes. Round the edges of the gutter and top of the curb with an edging tool to a radius of 1/2 inch. Immediately after removing the front curb form, rub the face of the curb with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. Brush the front curb surface, while still wet, in the same manner as the gutter and curb top. Finish the top surface of gutter to grade with a wood float.

- C. Surface and Thickness Tolerances: Finished surfaces shall not vary more than 1/4 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

3.09 CLEAN UP

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project Site.

3.10 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 32 17 00

PARKING BUMPERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide precast concrete parking bumpers (wheel stops) with adhesives for complete secure installation.

1.2 SUBMITTALS

- A. Product Data/Shop Drawings: Submit for parking bumpers dimensions, anchorage, and locations in typical parking spaces.

1.3 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives, sealants, and caulks.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Description: Provide precast concrete parking bumpers (wheel stops).
- B. Accessibility Regulatory Requirements: Provide for assuring access for persons with disabilities in accordance with state and federal regulations.
 - 1. California Regulations: Comply with California Building Standards Code.
 - 2. Federal Regulations: Comply with Americans with Disabilities Act (ADA) Standards.
- C. Regulatory Requirements, Volatile Organic Compound (VOC) Emissions: Comply with applicable air quality management district for VOC emissions for adhesives.
- D. Parking Bumpers: Stock manufactured parking bumpers of not less than 3000 psi concrete, without holes.
- E. Epoxy Adhesive: Nontoxic epoxy adhesive as recommended by adhesive manufacturer for use with parking bumpers and capable of withstanding loads from automobile wheels; steel anchor devices are not acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Set parking bumpers in minimum two spots of epoxy adhesive at locations indicated and as required by applicable codes and regulations.
 - 1. Provide at front of each parking space unless otherwise indicated on Drawings.
- B. Set square and true with parking space lines.

END OF SECTION

SECTION 32 17 20

TACTILE WARNING SURFACES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide tactile warning surface to ensure tactile warning for persons with visual impairments as required by state and federal requirements.
- B. Related Sections:
 - 1. Section 09 90 00: Painted traffic lines and symbols.

1.2 REFERENCES

- A. California Building Standards Code, Title 24, requirements for access for persons with disabilities.
- B. Americans with Disabilities Act (ADA) Standards.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product literature.
- B. Samples: Submit sample of tactile warning surface material.

1.4 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives, sealants, and caulks.

1.5 PROJECT CONDITIONS

- A. Ensure substrates to receive tactile warning surfaces are smooth and flat with maximum variation of 1/8" in 10'-0".
- B. Ensure concrete is dry (maximum 7 percent moisture content) and exhibit negative alkalinity, carbonizing and dusting.
- C. Product selected shall be cast in place.

1.6 WARRANTY

- A. Extended Correction Period: Extend correction period to two years.
 - 1. Repair or replace tactile warning units which break, delaminate or otherwise fail under normal usage.

PART 2 - PRODUCTS

2.1 SYTEMS MANUFACTURERS

- A. ADA Solutions.
- B. Advantage Tactile Systems.
- C. Armor-Tile.
- D. SafetyStep TD.
- E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide tactile warning surfaces with accessories.
- B. Regulatory Requirements, Accessibility: Provide for assuring access for persons with disabilities in accordance with state and federal regulations.
 - 1. California Regulations: Comply with California Building Standards Code.
 - 2. Federal Regulations: Comply with Americans with Disabilities Act (ADA) Standards.
- C. Regulatory Requirements, Volatile Organic Compound (VOC) Emissions: Comply with applicable air quality management district for VOC emissions for adhesives.
- D. Regulatory Requirements, Slip-Resistance: Hard surface finishes to comply with requirements of authorities having jurisdiction for slip-resistant hard surfaces, including general code requirements and requirements for access for persons with disabilities.
- E. Tactile Warning Surface: Comply with applicable codes and regulations. Tactile warning surface shall differ from adjoining walking surfaces in resiliency or sound-on-cane contact.
 - 1. Type: Contractor option to choose systems from manufacturers listed and to ensure preparation of installation of tactile warning surfaces result in top surface of system to be flush with adjacent surfaces unless otherwise indicated.
 - a. Where otherwise indicated provide transition strips to comply with access requirements for ensuring smooth transition from adjacent surfaces to primary surface of tactile warning surfaces.
 - 2. Color: Comply with applicable codes and regulations; where options are provided as selected by Architect from full range of code approved colors available.
- F. Primers and Adhesives: Waterproof epoxy or modified epoxy type as recommended by system manufacturer for specified material and extra heavy-duty application.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine adjacent construction and ensure preparation for installation of tactile warning surfaces has been correctly coordinated.

3.2 PREPARATION

- A. Remove subsurface ridges, bumps and voids, and clean substrate.

3.3 INSTALLATION

- A. Spread cement evenly in quantity recommended by manufacturer to ensure adhesion over entire area of installation.
 - 1. Spread only enough adhesive to permit installation of tactile surface material before initial set.
- B. Set in place with tight, even joints, and full adhesion in accordance with manufacturer recommendations and installation instructions.
 - 1. Where radius installation is indicated, install with maximum 3/16" gap at leading edge of units using units designed for surface installation with tapered edges.
- C. Install units with tapered edges where edges of system are not recessed or not flush with adjacent surfaces.

3.4 CLEANING

- A. Remove excess adhesive from unit surfaces without causing damage to tactile surface or to adjacent surfaces.
 - 1. Clean surfaces in accordance with manufacturer's recommendations.

3.5 PROTECTION

- A. Prohibit traffic for not less than 48 hours after installation unless otherwise noted in manufacturer's literature.

END OF SECTION

SECTION 32 18 00

POURED SYNTHETIC PLAY SURFACE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide exterior poured synthetic play surface safety matting system.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate synthetic play surface with playground structures and adjacent surfaces.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's literature.
- B. Samples: Color range of tiles and exposed accessories.
- C. Certifications:
 - 1. Previous Installation: Installer to submit list of not less than five similar successful installations which have been in service for at least three years.
 - a. List owner, address of installation, service or maintenance organization, date of installation, contact person and phone number of contact person.
 - 2. Manufacturer Certification: Play surface manufacturer shall certify safety surface complies with CPSC and ASTM F1951 and meets requirements of ASTM F1292 for head-first fall from highest accessible portion of Project play equipment.
 - a. Certificate shall be dated after award of Contract, shall name Contractor and Contractor location, and Project along with Project location along with complete test information and test results.
 - 3. Submit manufacturer's representative's certification work has been installed in accordance with manufacturer recommendations.
- D. Extra Materials: Provide materials for patching, with Project name, product, location in Project, instructions for patching small areas, and contact for additional materials.

1.4 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for paints and coatings.
- B. Mock-Up: Provide minimum 100-sf mock-up of play surface installation, with edge and corner conditions, as approved by Architect.
 - 1. Approved mock-up may be incorporated into completed installation.

1.5 WARRANTY

- A. Special Warranty: Provide for repairing or replacing materials against bubbling, de-lamination, peeling, loss of integrity, poor ultraviolet stability, lack of permeability, and general deterioration due to weather.

- 1. Warranty Period: Two years.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Robertson Industries/TotTurf Supreme (800.858.0519).
- B. Safe Guard Surfacing Corp. (800.899.8703)/Safe Guard Safety Surface.
- C. SpectraTurf an ECORE Company (800.875.5788)/Spectra Pour.
- D. Surface America (800.999.0555)/PlayBond Poured-in-Place.
- E. Substitutions: Refer to Section 01 25 00

2.2 MATERIALS

- A. System Description: Provide exterior synthetic play surface safety matting system.
- B. Regulatory Requirements, Accessibility: Provide for assuring access for persons with disabilities in accordance with state and federal regulations.
 - 1. California Regulations: Comply with California Building Standards Code.
 - 2. Federal Regulations: Comply with Americans with Disabilities Act (ADA) Standards.
- C. Regulatory Requirements, Volatile Organic Compound (VOC) Emissions: Comply with applicable air quality management district for VOC emissions for adhesives.
- D. Regulatory Requirements, Slip-Resistance: Hard surface finishes to comply with requirements of authorities having jurisdiction for slip-resistant hard surfaces, including general code requirements and requirements for access for persons with disabilities.
- E. Design Requirements: Playground safety matting shall comply with following standards.
 - 1. Safety Guidelines of US Consumer Product Safety Commission CPSC "Handbook for Public Playground Safety" and IPEMA Certified.
 - 2. ASTM F1951 Safety Performance Specification for Playground Equipment for Public Use.
 - 3. Americans with Disabilities Act (ADA) Standards requirements for making playgrounds accessible to persons with disabilities, both for children playing and for adult supervision.

- F. Performance Requirements: Play area is to be inspected by NPSI certified Playground Inspector as required by California Playground Safety Regulations and Project requires Inspector to certify play area to be compliant.
- G. Synthetic Play Surface: Provide resilient poured-in-place type synthetic play surface.
 - 1. Type: Poured in place EPDM rubber granules designed to provide seamless and porous surface for playgrounds.
 - 2. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
 - 3. Fire Resistance: Minimum 0.40 critical radiant flux, ASTM E648 or NFPA 253.
 - 4. Shock Absorbing Properties: Maximum 200 G-max at 6" fall height when tested between 32 and 120-degrees F, and 1000 HIC (head injury criteria), ASTM F1292.
 - 5. Wheelchair Mobility: Comply with ASTM F1951 to ensure wheelchair movement when tested on 2% grade.
 - 6. Water Permeability: Rated 43 g/sf/minute or higher, with minimum lateral flow of 1.73 g/cf/minute at 2% slope.
 - 7. Coefficient of Friction: 1.0 or higher, wet or dry, ASTM D2047.
- H. Adhesives: Nontoxic type as recommended by surface manufacturer for substrate indicated.
- I. Accessories: Provide spot fillers and accessories as recommended by synthetic play surface manufacturer for complete installation as indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to installing play surface, ensure surfaces comply with play surface manufacturer recommendations.
- B. Ensure surfaces are clean and well cured, and properly sloped to drain.
- C. Do not commence work until surface conditions are within tolerances required for proper installation.

3.2 INSTALLATION

- A. Synthetic Play Surface: Comply with manufacturer's recommendations and installation instructions for poured in place installation of synthetic play surface over concrete.
 - 1. Filter Fabric: Install filter fabric over crushed base to receive synthetic play surface.

2. Base Course: Resilient rubber and binder, not less than 1-1/2" thick; adjust thickness to comply with types of playground equipment in accordance with ASTM F1487.
3. Wear Course: Binder and EPDM rubber granules sized between 1 mm and 3 mm, colors and patterns as indicated on Drawings or as directed by Architect where colors and patterns are not indicated.
 - a. Screed and trowel wear course in accordance with manufacturer installation instruction, not less than 3/8" thickness.
 - b. Form edges flush with adjacent curbs; taper transitions with maximum 1:20 slope.
4. Match approved mock-up installation; carefully plan layout for configurations indicated.

B. Completed installation to be free of damaged and faulty tile units.

3.3 FIELD QUALITY CONTROL

- A. Field Inspection: Manufacturer's representative shall inspect work of Project on regular basis and provide certification play surface has been installed in accordance with manufacturer's recommendations and meets impact attenuation requirements.
 1. Correct defects and irregularities as advised by manufacturer's representative.

END OF SECTION

SECTION 32 31 20

DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide decorative steel fence system including gates, manual and automatically operated, framing, and accessories as required for complete fence installation as indicated.
 - 1. Excavate for post bases and provide concrete anchorage for freestanding posts, provide sleeves and grout posts embedded in concrete construction.
- B. Related Sections:
 - 1. Section 01 50 00: Temporary construction fence.
 - 2. Section 05 50 00: Miscellaneous metal fabrications.
 - 3. Section 32 31 13: Chain link fence.

1.2 REFERENCES

- A. American Welding Society (AWS): D1.1, Structural Welding Code.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Design/Build: Provide special engineering to ensure compliance with applicable codes and Contract Documents.

1.4 SUBMITTALS

- A. Product Data: Submit product literature for gates and operators, gate hardware, grout, and manufactured items.
- B. Shop Drawings: Indicate fence and gate layout, spacing of components, connections, fabrication details, accessories, and anchorage.
 - 1. Indicate profiles, sizes, connections, and anchorage.
 - 2. Provide templates as required for anchor installation by others.
- C. Samples: Submit samples fence section with welds and finish.
- D. Design/Build Certificates: Submit certification signed by California licensed structural engineer indicating compliance with Contract Documents and code requirements.

1.5 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for paints and coatings.

- B. Fabricator: Firm with minimum five years successful experience fabricating custom steel fences and gates like those required for Project.
 - 1. Provide fence and gates by same fabricator.
- C. Mock-Up: Provide three panels and posts of Owner and Architect review; approved mock-up may be incorporated into Project where undamaged.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Description: Provide decorative steel fence system including gates, manual and automatically operated, framing, and accessories.
- B. Regulatory Requirements: Design fence and gates to support loads as required by California Building Standards Code.
- C. Performance Criteria: In addition to applicable code requirements, design to support minimum lateral force of 50 lbs./lin. ft. uniform load and 200 lbs. at any single point without permanent set or damage; ASTM E935.
- D. Steel Shapes, Plates and Bars: ASTM A36; shapes and sizes as indicated on Drawings; provide weights suitable for specified loads; galvanized.
- E. Structural Steel Sheet: Hot rolled, ASTM A1011; or cold rolled, ASTM A1008, Class 1; of grade required for design loading; galvanized.
- F. Steel Tubing: Cold formed ASTM A500; or hot rolled, ASTM A501; minimum Grade B; seamless where exposed; galvanized.
- G. Grout: Non-shrink meeting ASTM C1107 non-metallic, pre-mixed, factory-packaged, non-staining, non-corrosive; type specifically recommended by manufacturer as applicable to job condition.
- H. Fasteners and Rough Hardware: Type required for specific usage; provide zinc-coated fasteners.
- I. Welding Materials: AWS D1.1, type required for materials being welded.
- J. Primer: Provide primers as recommended by paint manufacturers for substrates and paints specified in Section 09 90 00 – Painting and Coating.
 - 1. Galvanizing Repair Paint: High zinc-dust content paint for regalvanizing welds in galvanized steel.
- K. Concrete: ASTM C94, normal Portland cement, 2,500 psi at 28 days, 2" to 3" slump, 2 to 4 percent entrained air.

2.2 FABRICATION

- A. Framework: Design and fabricate fence to withstand anticipated loads, including loads from people climbing on fence.
 - 1. Configurations: As indicated, welded construction unless otherwise indicated.
 - 2. Fittings: Provide fittings and accessories as required for complete installation.
- B. Fencing Infill Panels:
 - 1. Manufacturer/Basis of Design: Bok Modern.
 - 2. Patterns: Provide Bok Modern perforated patterns; refer to Drawings.
 - 3. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- C. Fence Infill Panels: Manufacturer's standard configurations based on Orsogril Talia or comparable louver pattern with between 80% and 100% visual blocking, with manufacturer's standard shop finish.
 - 1. Manufacturers:
 - a. A & T Iron Works, Inc.
 - b. Ametco Manufacturing Co.
 - c. Barnett Bates Corporation.
 - d. Substitutions: Refer to Section 01 25 00.
 - 2. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- D. Gates: Fabricate gates as indicated, welded construction.
 - 1. Swing Gates: Provide complete with hardware.
 - a. Pivots: Lift-off type, extra heavy-duty ball bearing pivots, sized for anticipated gate loads plus additional live loads of up to 500 lbs per gate leaf, without damage to system.
 - 1) Provide full surface offset pivots to permit 180-degree opening, minimum 1-1/2 pair per gate leaf.
 - 2) Provide set screws to prevent accidental gate removal due to seismic activities or vehicular impact.
 - 3) Weld pivot to gates and frames.
 - b. Cane Bolts: Custom fabrications as indicated.
 - c. Accessories: Keepers, stops, and accessories as required for complete, secure manually operated fence gate installation.

2. Sliding Gates: Provide cantilever type gates which allow clear opening when gate is open; ball bearing wheels and rollers; provide guides to keep gates in-line during opening and closing cycles.
 - a. Hardware: Design hardware to support gates plus additional 500 lbs. live load without exceeding limits of gate operator and to allow manual opening and closing of gates during power failures.
 - 1) Manual Operation: Maximum 50 lbs. pressure to move gate.
3. Gate Operators: Heavy duty commercial quality gate operator sized as recommended by operator manufacturer for size of gate but not less than 1 H.P. motor with internal overload protection.
 - a. Operation: Wire operator to allow both remote control and key operation; gates to "auto close" after adjustable preset time.
 - 1) Key Operation: Minimum 6 pin cylinder key boxes mounted on posts at locations indicated; posts to be included in Work of this section.
 - 2) Remote Controls: Single channel digital radio transmitters with over 1000 Owner changeable codes, using 9-volt batteries
 - a) Provide 10 remote controls.
 - 3) Safety Devices: Provide as required by applicable codes, including photo electric non-contact reversing control and electric gate edge to reverse gate operator.
 - b. Accessories: Provide as required for complete, automatically operated secure fence gate installation in configuration indicated.
- E. Fabricate items with joints neatly fitted and properly secured.
- F. Grind exposed welds continuous, smooth and flush with adjacent finished surfaces, and ease exposed edges to approximate 1/32" uniform radius.
- G. Exposed Mechanical Fastenings (Slide Gate Hardware Only): Flush countersunk fasteners unobtrusively located, consistent with design of structure.
- H. Fit and shop assemble in largest practical sections for delivery.
- I. Make exposed joints flush butt type, hairline joints where mechanically fastened.
 1. Fabricate joints exposed to weather in manner to exclude water or provide weep holes where water could accumulate.
- J. Supply components required for proper anchorage of custom steel fence; fabricate anchorage and related components of same material and finish as custom steel fence.

- K. Finishing: Galvanize and prime paint custom steel fencing; comply with requirements of Section 09 90 00 – Painting and Coating for preparation and priming.
 - 1. Preparation: Thoroughly clean surfaces of rust, scale, grease and foreign matter prior to applying finishes.
 - 2. Galvanizing: Provide minimum ASTM A123 or A924 and A653 G90 coating; iron and steel hardware galvanized conforming to ASTM A153.
 - 3. Priming: Comply with requirements in Section 09 90 00 – Painting and Coating; do not shop prime surface areas requiring field welding; shop prime in one coat.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication.

3.2 INSTALLATION

- A. Install fence, gates, and accessories to provide rigid structure for configurations indicated as specified and in accordance with applicable code requirements.
- B. Install line, corner, and terminal posts plumb in locations indicated on Drawings.
 - 1. Coordinate embedded post sleeves with concrete work.
 - 2. Grout posts solid where indicated on Drawings.
- C. Install gates for free, easy operation.
 - 1. Install automatic gate operators in accordance with manufacturer recommendations and installation instructions for proper smooth operation; test gate operation and adjust as necessary for maximum lifespan of system.
- D. Obtain Architect's review prior to site cutting or making adjustments that are not part of scheduled work.
- E. Install components square and level, accurately fitted and free from distortion or defects detrimental to appearance or performance.
 - 1. Supply items required to be cast into or embedded in other materials to appropriate trades.
 - 2. Ensure alignment with adjacent construction; coordinate with related work to ensure no interruption in installation.
- F. Make provision for erection stresses by temporary bracing; keep work in alignment.
- G. Field bolt and weld to match standard of shop bolting and welding; hide bolts and screws whenever possible, where not hidden, use flush countersunk fastenings.

1. Perform field welding in accordance with AWS D1.1.
 2. Bolting permitted for slide fence hardware only.
- H. After installation, touch-up field welds and scratched and damaged surfaces; use same primer as used for shop coat.
- I. Replace items damaged in course of installation and construction.

END OF SECTION

SECTION 32 84 00

LANDSCAPE IRRIGATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section includes automatic-control irrigation system as shown on the Drawings and as follows:

1. Trenching
2. Piping and Fitting
3. Valving
4. Assemblies
5. Automatic Controllers
6. Specialties
7. Wiring
8. Drip Irrigation
9. Cleanup
10. Connections to existing mains or municipal water systems.
 - a. Related work:
 - 1) Section 32 01 90: Operation and Maintenance
 - 2) Section 32 93 00: Planting
 - b. Definition: The word Architect as used herein shall refer to the Landscape Architect or the Owner's authorized representative.

1.2 QUALITY ASSURANCE AND REQUIREMENTS

- A. Permits and Fees: The Contractor shall obtain and pay for any normally required permits, fees and inspections as required.
1. Manufacturer's Directions: Manufacturer's directions and detailed Drawings shall be followed in cases where the manufacturers of articles used in this contract furnish directions covering points not shown in the Drawings and Specifications.
 2. Ordinances and Regulations: Any local, municipal and state laws, and rules and regulations governing or relating to any portion of this work, are hereby

incorporated into and made a part of these Specifications and their provisions shall be carried out by the Contractor. Anything contained in these Specifications shall not be construed to conflict with any of the above rules and regulations or requirements of the same. However, when these Specifications and Drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of these Specifications and Drawings shall take precedence.

- a. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
- b. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.

1.3 SUBMITTALS

A. Material List

1. Furnish the articles, equipment, materials, or processes specified by name in the Drawings and Specifications per requirements of Division 1 or the General Provisions. No substitutions will be allowed without prior written approval by the Architect.
2. Submit a complete materials list to Architect prior to performing any work. Material list shall include the manufacturer, model number and description of all materials and equipment to be used according to example as follows:

Item	Description	Manufacturer	Model No.
1	Backflow Preventer		
2	Controller		
3	Isolation Valve		
4	Etc.		

3. Irrigation submittals must be specific and complete. All items must be listed and should include solvent and primer, wire, wire connectors, valve boxes, etc. No copies of manufacturer's literature (catalog cuts) are required as submittal information.
4. Equipment or materials installed or furnished without prior approval of the Architect may be rejected and the Contractor required to remove such materials from the site at his own expense.
5. Approval of any item, alternate or substitute indicates only that the product or products apparently meet the requirements of the Drawings and Specifications on the basis of the information or samples submitted.

B. Record Drawings

1. Refer to Division 1 or General Provisions.

2. Record Set During the Work: At site, maintain not less than one complete set of Drawings as a Field Record Set. Record by showing depth and dimensioning horizontally from two permanent points of reference, building corners, sidewalk, or road intersections, etc., the location of the following items:
 - a. Connection to existing water lines.
 - b. Connection to existing electrical power.
 - c. Ball valves.
 - d. Control valves.
 - e. Quick coupling valves.
 - f. Routing of mainline (pressurized line).
 - g. Routing of control wiring.
 - h. Items specified under Division 1 or as directed by the Architect.

C. Final Record Drawings

1. Prior to substantial completion, the Architect will order for the Contractor, at the Contractor's expense, one complete set of reverse-reading, reproducible Mylar transparencies.
2. The Contractor shall transfer recorded changes in the work indicated on the field set to the reproducible set, neatly and clearly, technically correct, and drafted in ink by a skilled draftsman.
3. On or before the date of the final inspection, the Contractor shall deliver the corrected and completed reproducible plans to the Architect with a transmittal containing the date, project title and number, Contractor's name, address and authorized signature.
4. Delivery of the reproducible plans will not relieve the Contractor of the responsibility of furnishing required information that may be omitted from the prints.

D. Controller Charts

1. Record Drawings shall be approved by the Architect before controller charts are prepared.
2. Provide one controller chart for each controller supplied. The chart shall show the area controlled by the automatic controller and shall be the maximum size that the controller door will allow.
3. The chart shall be a reduced drawing of the actual as-built system. However, in the event the controller sequence is not legible when the drawing is reduced, it shall be enlarged to a size that will be readable when reduced.

4. The chart shall be a black and white bond print, and a different color highlighter shall be used to indicate the area of coverage for each station.
5. When completed and approved, the chart shall be hermetically laminated between two pieces of plastic, each piece being minimum 10 mils thick.
6. These charts shall be completed and approved prior to final inspection of the irrigation system.

E. Operation and Maintenance Manuals

1. Prepare and deliver to Owner within 10 days prior to completion, three hardcover ring binders with the following in each:
 - a. Index
 - b. Guarantee statement.
 - c. Address and phone number of Contractor
 - d. Catalog and parts sheets on every material and equipment installed under this Contract with name, address and phone numbers of manufacturers and local representatives.
 - e. 11" x 17" color copy of controller charts (not laminated).
 - f. Complete operating and maintenance instructions on all major equipment.
2. In addition to the above-mentioned maintenance manuals, provide the Owner's maintenance personnel with instructions for major equipment and show evidence in writing to the Architect at the conclusion of the project that this service has been rendered.

F. Extra Equipment to be Furnished

1. Furnish extra materials described below (match products installed), packaged with protective covering for storage and identified with labels describing contents.
 - a. Special Tools: Two sets of special tools required for removal, disassembling and adjusting each type of sprinkler, drip emitter, and valve on the project
 - b. Controller Keys: Two keys for each automatic controller.
 - c. Emitter Units: Equal to 10% percent of amount installed for each type indicated, but no fewer than 10 units.
 - d. Drip Tubing Units: Equal to 10 percent of amount installed for each type indicated, but no fewer than 10 units.
2. The above-described equipment shall be turned over to the Owner at the conclusion of the project. Before final inspection can occur, evidence that the Owner has received material must be shown to Architect.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Handling of PVC Pipe and Fittings: The Contractor is cautioned to exercise care in handling, loading, unloading, and storing of PVC pipe and fittings.
 - 1. All PVC pipes shall be transported in a vehicle which allows the length of pipe to lie flat so as not to subject it to undue bending or concentrated external load at any point.
 - 2. Do not drop PVC pipe on hard surfaces.
 - 3. Any section of pipe that has been dented or damaged is to be discarded.
 - 4. If damaged material is installed, it shall be replaced with new material.

1.5 WARRANTY

- A. The contractor shall fully warrant and agree to replace any poor, inadequate or defective materials and workmanship for one year from the date of acceptance of completed Irrigation System. The Architect shall be the sole judge of the acceptability of materials or workmanship.
- B. Replacement: Materials found to be defective, missing or in poor condition during the warranty period shall be replaced immediately. The Architect shall be the sole judge as to the condition of material. Material to be replaced during the warranty period shall be replaced by the Contractor within 15 days of written notification by Owner.

1.6 PERFORMANCE REQUIREMENTS

- A. Handling Location of Bubblers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards.
- B. Explanation of Drawings
 - 1. Drawings are diagrammatic and indicative of the work to be installed. All offsets, fittings, sleeves, etc., which may be required, may not be indicated. Carefully investigate the structural and finished conditions affecting all of the work and plan the work, accordingly, furnishing such fittings, etc., as may be required to meet such conditions. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, architectural features, drainage systems, or hardscape construction.
 - 2. Do not install the irrigation system as shown on the Drawings when it is obvious in the field those obstructions, grade differences, or discrepancies in area dimensions exist that might not have been considered in the engineering.
 - a. Any discrepancy in Drawings shall be brought to the attention of the Architect. Contractor assumes full responsibility for work installed without clarification.

3. The final location and exact positioning of automatic controllers, backflow prevention assemblies, gate valves, pressure regulators, or other equipment shall be approved by the Owner's authorized representative prior to installation.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Use only new materials of brands and types noted on the Drawings, as specified herein, or approved equivalents.

2.2 PIPE

- A. The pressure supply line between the water meter and the backflow prevention device shall be type K copper.
- B. Non-pressure lines 3/4 inch in diameter and larger downstream of the remote-control valve shall be SCH 40 solvent weld PVC conforming to ASTM D1785. Bar Stock: ASTM A276, Type 302 or 304.

2.3 POLY VINYL CHLORIDE (PVC) PIPES, TUBES & FITTINGS

- A. PVC pipe, tubes & fittings shall be of the schedule rating designated on the contract Drawings.
- B. PVC pipe shall continuously bear the following markings.
 1. Nominal pipe size.
 2. PVC Schedule or class.
 3. Type of plastic material in standard code
 4. Pressure rating in psi
 5. SDR for class rated pipe
 6. ASTM designation
 7. National Sanitation Foundation (NSF) approval.
 8. Manufacturer's name or trademark
 9. Date of extrusion.
- C. Schedule rated PVC Pipe shall be made from NSF approved Type 1, Grade I, PVC compound conforming to ASTM D-1785.
- D. PVC Fittings, Solvent and Primer.
 1. For schedule rated pipe, fittings shall correspond to the same schedule rating.

2. For class rated pipe, fittings shall be Schedule 40.
3. PVC solvent-weld fittings shall be Type 1, Grade I, NSF approved, conforming to ASTM test procedure D-2466.
4. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable IPS schedule and NSF seal of approval.
5. Solvent cement and primer for PVC solvent-weld pipe and fittings shall be of the type prescribed by the pipe manufacturer. Installation methods shall be according to ASTM D-2885. Extruded Bars and Shapes: ASTM B221, alloy 6061-T6 or 6063-T6 for bearing bars of gratings and shapes and 6061-T6 for grating cross bars.

2.4 BRASS PIPE AND FITTINGS

- A. Where indicated on the Drawings or required by Code, use red brass screwed pipe conforming to ASTM B43.
- B. The fittings shall be red brass.

2.5 BACKFLOW PREVENTION DEVICE

- A. Backflow preventers shall be one of the approved reduced pressure principal devices listed by the California Department of Health Services, Division of Drinking Water and Environmental Management, 601 North 7th Street, Mailing Station (MS) 92, P.O. Box 942732, Sacramento, CA 94234-7320.
- B. Backflow preventers shall be factory assembled and shall include two (2) check valves, one (1) pressure differential relief valve, two (2) shut-off valves, and four (4) test cocks. The backflow preventer and valves shall be the same size as the pipeline in which they are installed, unless otherwise shown on the plans.
- C. Backflow preventer shut-off valves shall be manufactured from bronze and shall be resilient seated and fully ported ball valves. Threaded type shut-off valves shall be provided with a union on one side of each valve. Unions shall be brass.

2.6 VALVES

- A. Isolation Valves.
 1. Shall be as called out on Drawings and details.
 2. Brass and stainless steel, fully ported ball valves
 3. 150 PSI at 73°
- B. Automatic Electric Control Valves.
 1. Shall be as called out on Drawings and details.

2. Normally closed, diaphragm type with manual flow adjustment, and operated by 24-V ac solenoid.

3. Automatic control valve shall have a brass or bronze body and bonnet.

C. Master Control Valve.

1. Shall be as called out on Drawings and details.
2. Normally closed, diaphragm type with manual flow adjustment, and operated by 24-V ac solenoid.
3. Master control valve shall have a brass or bronze body and bonnet.

D. Pressure Reducing Valve and Wye Strainer.

1. The pressure reducing valve shall be Wilkins Model #500HLR with wye strainer and bronze body. Size and pressure setting shall be as noted on irrigation Drawings.
2. The Wye strainer used alone shall be Wilkins Model #YBXL with bronze body. Size shall be as noted on irrigation Drawings.

E. Flow Sensor

1. Shall be as called out on Drawings and details.
2. Brass bodied, female threaded ends.

F. Drip Flush Valve.

1. Shall be as called out on Drawings and details.
2. Sch. 40 PVC bodied, female slip ends.

G. Check Valves.

1. Shall be as called out on Drawings and details.
2. Brass bodied, female threaded ends.

2.7 CONTROL WIRING

- A. Connections between the automatic controllers and the electric control valves shall be made with #14 THHN - UF 600-volt stranded copper wire manufactured for irrigation system use. Pilot wires shall be red.
- B. Common wires shall be white.
- C. Install in accordance with valve manufacturer's specifications and wire chart. In no case shall wire size be less than #14.

- D. Install control wires inside steel conduit, sweeps and junction boxes between the controller and the control valves.
- E. All control wire splices shall be made with waterproof wire connectors. Manufacturers: 3M DBY/R-6 or approved equal.
- F. All electrical work shall conform to local codes and ordinances. Above ground wires shall be conduit enclosed.

2.8 AUTOMATIC CONTROLLERS

- A. Shall be of the size and type shown on the Drawings.
- B. Controller shall be weather based, with a satellite service providing daily evapotranspiration data to allow for the self-adjusting of the programming.
- C. Automatic controllers shall be as indicated on the drawings complete with hookup to electrical sources.
- D. All controllers shall be enclosed in a vandal-resistant, waterproof enclosure.
- E. Controller shall be connected to a rain sensor as shown on the Drawings.

2.9 VALVE BOXES

- A. Plastic Valve Boxes (to be used when valve is in planting areas).
 - 1. For Drip System Flush valve, use.
 - a. 6" diameter x 9" deep round box, NDS or approved equivalent.
 - b. Use min 10" diameter extensions to achieve proper depth below assembly.
 - c. Lid shall be T-form, bolt-down type.
 - d. Label: heat brand lid with the text "FV" in 1" tall block letters.
 - 2. For Drip System Air Relief Valves, use.
 - a. 6" diameter x 9" deep round box, Rainbird #ARV050 or approved equivalent.
 - b. Label: heat brand lid with the text "ARV" in 1" tall block letters.

2.10 DRIP IRRIGATION EQUIPMENT

- A. Drip emitters and inline drip tubing shall be of the size and type shown on the Drawings.
- B. Single outlet emitters shall be a self-flushing and pressure compensating type. Emitter bodies shall be constructed of durable UV resistant plastic and have a self-piercing barb on the inlet side of the emitter. Regulating diaphragms shall be constructed of silicone rubber.

- C. Air / vacuum relief valve: ARV050
- D. Screen filters shall be manufactured by Rainbird with a pressure rating of at least 115 psi. Disc type filter element shall be minimum 150 mesh screen equivalent. Screen filters shall have glass reinforced nylon bodies and threaded male connections.

PART 3 – EXECUTION

3.1 INSPECTION OF EXISTING SITE CONDITIONS

- A. Before any work begins, a conference shall be held with the Owner's authorized representative and the Contractor regarding general requirements for the project.
- B. It is the responsibility of the Contractor to familiarize himself with future locations of walls, paving, grade differences, etc. He shall coordinate his work with the General Contractor and other Sub-Contractors for the location and installation of pipe sleeves through walls, footings, under paving, etc., and so that there is no difficulty in the subsequent planting of trees or shrubs which are shown in the plans.
- C. Exercise extreme care in excavating and working near existing utilities. The contractor shall be responsible for damage to utilities that are caused by his operation or neglect. Check existing utilities Drawings for existing utility locations. Before excavating, call Underground Service Alert, (800) 422-4133
- D. The contractor shall not willfully install the irrigation system as shown on the Drawings when it is obvious in the field that obstructions, grade differences, or differences in dimensions of areas exist that might not have been considered in the engineering.
 - 1. Such obstructions or differences shall be brought to the attention of the Owner's authorized representative.
 - 2. In the event this notification is not performed, the Contractor shall assume full responsibility for any revisions necessary.
- E. The contractor shall carefully check all grades to satisfy himself that he may safely proceed before starting work on the sprinkler irrigation system.

3.2 PREPARATION

- A. Physical Layout: Prior to installation, the Contractor shall stake out all pressure supply lines, routing and location of sprinkler heads. All layouts shall be approved by Architect prior to installation.

3.3 WATER SUPPLY

- A. The Contractor shall verify static pressure on site prior to commencement of any work.
- B. The system design is based upon the minimum operating pressure and maximum flow demand shown on the Drawings.

1. Contractor shall report any difference between the water pressure shown on the Drawings and the actual pressure at the point of connection to the Owner's authorized representative.
- C. All work required for proper point of connection and laying of irrigation supply line shall be in accordance with all applicable codes and ordinances.
- D. Connections shall be made at approximate locations as shown on Drawings. Contractor is responsible for minor changes caused by actual site conditions.

3.4 ELECTRICAL SUPPLY

- A. Electrical connections for automatic controller shall be made to electrical points of connection at approximate locations as shown on Drawings. Contractor is responsible for minor changes caused by actual site conditions.

3.5 INSTALLATION

A. Trenching

1. Dig trenches straight and support pipe continuously on bottom of trench. Lay pipe to even grade. Trenching excavation shall follow layout indicated on Drawings and as noted.
2. Provide for a minimum cover of 12" for all non-pressure lines.
3. Provide a minimum cover of 18" minimum for all non-pressure lines under paved areas.
4. Provide a minimum cover of 24" minimum for all pressure lines under paved areas.

B. Backfilling - General

1. The trenches shall not be backfilled until all required tests are performed. Trenches shall be carefully backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand or other approved materials, free from large clods of earth or stones. Backfill shall be mechanically compacted in landscaped areas to a dry density equivalent to adjacent undisturbed soil in planting areas. Backfill will conform to adjacent grades without dips, sunken areas, humps or other surface irregularities.
2. A fine granular material backfill will be initially placed on all lines. No foreign matter larger than 1/2" in size will be permitted in the initial backfill.
3. Flooding of trenches will be permitted only with approval of the Architect.
4. Under no circumstances shall truck wheels be used to compact soil.
5. Provide sand backfill a minimum of 6" cover and 2" under all piping routed under paving areas.

6. If settlement occurs and subsequent adjustments to the pipe, valves, planting, paving or other construction are necessary, the Contractor shall make all required adjustments without cost to the Owner.

C. Trenching and Backfill under Paving

1. Trenches located under areas where paving, asphaltic concrete or concrete will be installed shall be backfilled with sand (a layer three inches below the pipe and three inches above the pipe) and compacted to 90% compaction, using manual or mechanical tamping devices. Trenches for piping shall be compacted to equal the compaction of the existing adjacent undisturbed soil and shall be left in a firm unyielding condition. All trenches shall be left flush with the adjoining grade. Contractor shall set in place, cap, and pressure test all piping under paving prior to the paving work.
2. Generally, piping under existing walks is done by jacking, boring or hydraulic driving, but where any cutting or breaking of sidewalks and/or concrete is necessary, it shall be done and re-placed by the Contractor as part of the contract cost. Permission to cut or break sidewalks and/or concrete shall be obtained from the Architect. No hydraulic driving will be permitted under concrete paving.
3. Provide a minimum cover of 24" between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete paving.

D. Assemblies

1. Routing of sprinkler irrigation lines as indicated on the Drawings is diagrammatic. Install lines and various assemblies to conform to the details shown on Drawings.
2. Perform all directional changes using 45-degree elbows. No 90-degree elbows will be permitted without approval of Architect.
3. Install all assemblies in accordance with respective details. In absence of detail Drawings or Specifications pertaining to specific items required to complete work, perform such work in accordance with best standard practice with prior approval of Architect.
4. PVC pipe and fittings shall be thoroughly cleaned of dirt, dust and moisture before installation. Installation and solvent-welding methods shall be as recommended by the pipe and fitting manufacturer.
5. On PVC to metal connections, the Contractor shall work the metal connections first. Teflon tape or approved equivalent shall be used on all threaded PVC-to-PVC joints, and on all threaded PVC-to-metal joints. Light wrench pressure is all that is required. Where threaded PVC connections are required, use threaded PVC adapters into which the pipe may be welded.

E. Line Clearance: All lines shall have a minimum clearance of six inches from each other and from lines of other trades. Parallel lines shall not be in-stalled directly over one another.

F. Automatic Controller

1. Install as per manufacturer's instructions. Remote control valves shall be connected to the controller in numerical sequence shown on the Drawings.
2. The Architect shall approve the final location of automatic controllers. Unless otherwise noted on the plans, the 120-volt electrical power to the automatic controller location to be furnished by others. The final electrical hookup shall be the responsibility of the irrigation Contractor. All electrical work shall conform to local codes, ordinances, and governing authorities having jurisdiction.
3. Install a line voltage surge device (intermatic ag2401c3/ or square d sdsa1175) for 120v in a junction box prior to controller.
4. Grounding for the irrigation controller is to be installed per the manufacturer's specifications and per the American Society of Irrigation Consultants guideline 100-2002 for earth grounding electronic equipment in irrigation systems found at www.asic.org/design_guides.aspx. For technical support regarding the irrigation controller or grounding please contact the manufacturer's technical services.
5. Rain sensor shall be installed on building eave adjacent to the controller. The sensor shall be mounted in a location in full sun and open to rainfall. The sensor shall be no more than 200' from wireless receiver. mount wireless receiver on or adjacent to the irrigation controller.

G. Control Wiring

1. An expansion curl shall be provided within three feet of each wire connection.
2. A minimum of one additional blank remote control valve station wire shall be run from the controller to the furthest point of each separate leg of the mainline. Terminate wire in nearest valve box and tag "blank" in valve box and in controller.
3. Wiring shall occupy the same trench and shall be installed along the same route as the pressure supply lines wherever possible.
4. Where more than one wire is placed in a trench, the wiring shall be taped together at intervals of 12 feet.
5. All connections shall be of an approved type and shall occur in a valve box. Provide an 18-inch service loop at each connection.
6. An expansion loop of 12 inches shall be provided at each wire connection and/ or directional turn, and one of 24 inches shall be provided at each remote-control valve.

7. A continuous run of wire shall be used between the controller and each remote-control valve. Under no circumstances shall splices be used without prior approval.
8. Wire running from controller to control valves shall be AWG-UF 600V, No. 14 minimum, solid core, single conductor copper wire, and style Br. (direct burial type).
9. Spare control wires shall be run to valve box locations as shown on the plans. Provide an 18-inch expansion loop at valve box.

H. Remote Control Valves: Install where shown on Drawings and details.

I. Low Head Drainage: It is the intention of the design to indicate check valves and/or low head drain valves to prevent water from running out of sprinkler heads when systems are shut off. The Contractor shall include as part of the cost of his work installing any necessary check valves and/or low head drain valves which are necessary and may not be shown on the plans.

J. Flushing of System

1. After all the new sprinkler pipelines and risers are in place and connected, and prior to installation of sprinkler heads, the control valves shall be opened and full head of water used to flush out the system.
2. Sprinkler heads shall be installed only after the flushing of the system has been accomplished to the complete satisfaction of the Architect.

K. Drip Irrigation installation

1. Install control valves and rigid PVC distribution lines prior to planting operations.
2. Drip tubing shall be installed in parallel rows not to exceed the spacing indicated on the Drawings and details. The perimeter row of tubing in all planters shall be installed a maximum of 4" from the edge of the planter, all interior rows shall be evenly spaced at a distance not exceeding 16" on center. Closer spacing of the tubing may be required in some or all planters due to planter size.
3. Flush and adjust systems, eliminate leaks, operate for a one-hour period, then re-check and re-adjust systems.
4. Complete planting and mulching operations.

3.6 TEMPORARY REPAIRS

- A. The Owner reserves the right to make temporary repairs as necessary to keep the sprinkler system equipment in operating condition. The exercise of this right by the builder/developer shall not relieve the Contractor of his responsibilities under the terms of the guarantee as herein specified.

3.7 FIELD QUALITY CONTROL

A. Adjustment of the System

1. The Contractor shall flush and adjust all sprinkler heads for optimum performance and to prevent over-spray onto walks, roadways, and buildings.
2. If it is determined that adjustment in the irrigation equipment will provide proper and more adequate coverage, the Contractor shall make such adjustments prior to planting. Adjustments may also include changes in nozzle size and degrees of arc as required.
3. The Contractor shall lower raised sprinkler heads within 10 days after notification by Owner.

3.8 CLEAN-UP

A. Cleanup shall be made as each portion of work progresses.

1. Refuse and excess dirt should be removed from the site.
2. All walks and paving shall be swept or washed down.
3. Any damage sustained on the work of others shall be repaired to original conditions acceptable to Owner and Architect.

B. Cleanup shall be performed at the end of each working day, and a maximum cleanup effort shall be made for each weekend by the Contractor in a manner satisfactory to the Owner.

3.9 FINAL OBSERVATION PRIOR TO ACCEPTANCE

A. The Contractor shall operate each system in its entirety for the Architect at time of final observation. Any items deemed not acceptable shall be reworked to the complete satisfaction of the Architect.

B. The Contractor shall show evidence to the Architect that the Owner has received all accessories, extra parts, charts, record Drawings, and equipment as required before final observation can occur.

3.10 OBSERVATION SCHEDULE

A. The contractor shall be responsible for notifying the Architect in advance for the following observations according to the time indicated.

1. Pre-job Conference - Seven days.
2. Lateral line and bubbler installation - 48 hours.
3. Final observation - Seven days.

B. When inspections have been conducted by someone other than the Architect, show evidence of when and by whom these inspections were made.

- C. No observation shall commence without adequate preparation or as-built Drawings. In the event the Contractor calls for an observation without as-built Drawings without completing previously noted corrections, or without preparing the system for observations, he shall be responsible for reimbursing the Architect at the hourly rate in effect at the time the observation portal-to-portal (plus transportation costs) for the inconvenience. No further inspections will be scheduled until this charge has been paid.

END OF SECTION

SECTION 32 92 00

TURF AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes **sodding**.

1.2 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.
- D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product certificates.
- C. Planting Schedule: Indicating anticipated planting dates.

1.4 QUALITY ASSURANCE

- A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.
- B. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Sod: Harvest, deliver, store, and handle sod according to requirements in TPI's "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding."

1.6 LAWN MAINTENANCE

- A. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
 - 1. Sodded Lawns: **30** days from date of Substantial Completion.
- B. Mow lawn as soon as top growth is tall enough to cut. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowing.

PART 2 - PRODUCTS

2.1 TURFGRASS SOD

- A. Turfgrass Sod: Certified complying with TPI's "Specifications for Turfgrass Sod Materials" in its "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.
- B. Turfgrass Species: Sod of grass species as follows:
 - 1. Full Sun: Tiffway II, Bermuda Grass

2.2 PLANTING MATERIALS

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of **6** percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.
 - 1. Topsoil Source: Reuse surface soil stockpiled on-site and supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Verify suitability of stockpiled surface soil to produce topsoil.
 - 2. Topsoil Source: Amend existing in-place surface soil to produce topsoil. Verify suitability of surface soil to produce topsoil. Surface soil may be supplemented with imported or manufactured topsoil from off-site sources.
- B. Inorganic Soil Amendments:
 - 1. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through No. 6 sieve and a maximum 10 percent passing through No. 40 sieve.
- C. Organic Soil Amendments

1. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8. Add 6 cubic yards of stabilized nitrogen organic amendment derived from redwood, fir, or cedar sawdust. Add 15 pounds of 12-12-12 commercial fertilizer and 10 pounds of soil sulfur.
2. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.

D. Fertilizer:

1. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - a. Composition: Rely on agronomic soils report for composition.
2. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

E. Mulches:

1. Compost Mulch (per Ornamental Grasses): Well-composted, stable, weed-free and debris free organic matter, pH range of 5.5 to 8.

2.3 PLANTING SOIL MIX

- A. Planting Soil Mix: Mix topsoil with the following soil amendments and fertilizers. Add 6 cubic yards of stabilized nitrogen organic amendment derived from redwood, fir, or cedar sawdust. Rely on soils report for appropriate ratios.

PART 3 - EXECUTION

3.1 LAWN PREPARATION

- A. Newly Graded Subgrades: Loosen subgrade to a minimum depth of **6 inches**. Remove stones larger than **1 inch** in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
1. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.
 2. Spread planting soil mix to a depth of **6 inches** but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

- B. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare surface soil as follows:
 - 1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
 - 2. Loosen surface soil to a depth of at least of **6 inches**. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top **6 inches** of soil. Till soil to a homogeneous mixture of fine texture.
 - 3. Remove stones larger than **1 inch** in any dimension and sticks, roots, trash, and other extraneous matter.
 - 4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
- C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.
- D. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- E. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

3.2 SODDING

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
- C. Saturate sod with fine water spray within two hours of planting. During the first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.3 SATISFACTORY LAWNS

- A. Satisfactory Sodded Lawn: At end of maintenance period, a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities.
- B. Reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.

END OF SECTION

SECTION 32 93 00

LANDSCAPE PLANTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the supplying and installation of the following:
 - 1. Trees.
 - 2. Shrubs.
 - 3. Ground cover shrubs.
- B. Related Sections:
 - 1. Section 01 56 39 - "Temporary Tree and Plant Protection"
 - 2. Section 32 84 00 - "Landscape Irrigation"

1.2 DEFINITIONS

- A. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for kind, type, and size of exterior plant required.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Planting Soil: Native topsoil, or surface soil modified to become topsoil; mixed with soil amendments.
- D. Sub-grade: Surface or elevation of subsoil remaining after completing excavation.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Certificates: For each type of manufactured product, signed by product manufacturer, and complying with the following:
 - 1. Manufacturer's certified analysis for standard products.
 - 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- C. Qualification Data: For landscape Installer.

- D. Material Test Reports: For existing surface soil.
- E. Planting Schedule: Indicating anticipated planting dates for exterior plants.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in the successful establishment of exterior plants. The installer shall have a valid contractor C-27 license.
 - 1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when exterior planting is in progress.
- B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- C. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; pH; and mineral and plant-nutrient content of topsoil.
 - 1. Report suitability of topsoil for plant growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.
- D. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."
- E. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes.
- F. Observation: City authorized representatives may observe trees and shrubs at site before planting for compliance with requirements for genus, species, variety, size, and quality. City authorized representative retains right to observe trees and shrubs further for size and condition of balls and root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
 - 1. Notify Owner's authorized representative of planting materials seven days in advance of delivery to site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not prune trees and shrubs before delivery, except as approved by City authorized representative. Protect bark, branches, and root systems from sunscald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery.
- B. Handle planting stock by root ball, container, or box.

- C. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants trees in shade, protect from weather and mechanical damage, and keep roots moist.

- 1. Do not remove container-grown stock from containers before time of planting.
- 2. Water root systems of exterior plants stored on-site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.6 COORDINATION

- A. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.7 WARRANTY

- A. Special Warranty: Warrant the following exterior plants, for the warranty period indicated, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, or incidents that are beyond Contractor's control.
 - 1. Warranty Period for Trees and 5-gallon Shrubs: One year from date of Substantial Completion.
 - 2. Warranty Period for Ground Cover 1-gallon plants: Three months from date of Substantial Completion.
 - 3. Remove dead exterior plants immediately. Replace immediately unless required to plant in the succeeding planting season.
 - 4. Replace exterior plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
 - 5. A limit of one replacement of each exterior plant will be required, except for losses or replacements due to failure to comply with requirements.

PART 2 - PRODUCTS

2.1 TREE AND SHRUB MATERIAL

- A. General: Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sunscald, injuries, abrasions, and disfigurement.
- B. Grade: Provide trees and shrubs of sizes and grades complying with ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to City authorized representative, with a proportionate increase in size of roots or rootballs.

- C. If formal arrangements for consecutive order of trees or shrubs are shown, select stock for uniform height and spread.

2.2 GROUND COVER PLANTS

- A. Ground Cover: Provide ground cover of species indicated, established and well rooted in pots, or similar containers, and complying with ANSI Z60.1.

2.3 ORGANIC SOIL AMENDMENTS

- A. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.

2.4 FERTILIZER

- A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.
- B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.5 MULCHES

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
 - 1. Type: Shredded Bark Mulch, TV400 per Tierra Verde Industries (949) 551-0363

2.6 STAKES AND GUYS

- A. Upright Stakes: Sound, new pressure-preservative-treated lodge pole, free of holes, cross grain, and other defects, 2-inch diameter by length indicated, pointed at one end.
- B. Rubber Tree Ties: Per Detail or approved equal.

2.7 PLANTING SOIL MIX

- A. Planting Soil Mix: Mix topsoil with the following soil amendments and fertilizers in the following quantities:
 - 1. Ratio of Loose Wood Derivatives to Topsoil by Volume: 1:4.
 - 2. Weight of Commercial Fertilizer per 1000 Sq. Ft.: 15 lbs.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive exterior plants for compliance with requirements and conditions affecting installation and performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.
- B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Lay out individual tree and shrub locations and areas for multiple exterior plantings.

3.3 PLANTING BED ESTABLISHMENT

- A. Loosen sub-grade of planting beds to a minimum depth of 4 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Spread amendments and fertilizer onto surface, and thoroughly incorporate into the top 6" depth of soil by roto-till, or equal.
- B. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
- C. Restore planting beds if eroded or otherwise disturbed after finish grading and before planting.

3.4 TREE AND SHRUB EXCAVATION

- A. Pits and Trenches: Excavate circular pits with sides sloped inward. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation.
 - 1. Excavate approximately three times as wide as ball diameter for container-grown stock.
- B. Subsoil removed from excavations may be used as backfill.
- C. Obstructions: Notify City authorized representative if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
- D. Drainage: Notify City authorized representative if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.

3.5 TREE PLANTING

- A. Set container-grown stock plumb and in center of pit or trench with top of root ball 1 inch above adjacent finish grades.
 - 1. Carefully remove root ball from container without damaging root ball or plant.
 - 2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.
- B. Organic Mulching: Apply 3-inch average thickness of organic mulch extending 12 inches beyond edge of planting pit or trench. Do not place mulch within 3 inches of trunks or stems.

3.6 SHRUB PLANTING

- A. Shrub installation.
 - 1. Positioning: After removing plant from container, scarify side of root ball to prevent formation of girdling roots and position plant in planting pit.
 - 2. Backfilling: Use planting soil mix to backfill plant pits. Set each plant plumb and brace rigidly in position until planting soil has been tamped solidly around the ball and roots. When plant pits have been backfilled approximately two-thirds (2/3) full, water thoroughly and saturate root ball before installing remainder of the backfill mix, eliminating all air pockets. Install remainder of mix to top of pit.
 - 3. Where fertilizers are recommended, use a slow-release fertilizer. Place evenly distributed in plant pits when backfilled two-thirds (2/3) to finish grade according to the schedule.
 - 4. Adjustment: Adjust plants to that after full settlement has occurred; the natural grade at the base of the plants is one (1) inch above the adjacent planting finish grade.
- B. Watering Basin: Form saucer with four (4) inches high berm centered around shrub pits twelve (12) inches wider than ball diameter.
- C. Watering: Water all plants immediately after planting.
- D. Labels: Remove all nursery-type plant labels from plants.

3.7 STAKING

- A. Upright Staking and Tying: Stake all single trunk trees. Use a minimum of 2 stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend at least 72 inches above grade. Set vertical stakes and space to avoid penetrating root balls or root masses. Support trees with two rubber ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

3.8 WEED ABATEMENT

A. Weed Abatement Prior to Planting:

1. Water all areas thoroughly and uniformly. Continue watering at the frequency and duration necessary to germinate all residual weed seeds, and as directed by the Agency's Authorized Representative.
2. Unless otherwise directed, maintain watering for not less than three (3) weeks.
3. When perennial weeds appear, apply approved contact herbicide over affected areas. Apply in accord with manufacturer's instructions.
4. When annual weeds appear, apply approved contact herbicide over affected areas. Apply in accord with manufacturer's instructions.
5. Do not water affected areas for a period of four (4) days minimum, following application of contact herbicides.
6. Follow manufacturer's instructions relating to time required for chemicals to effectively destroy weed growth.
7. Resume watering and, continue for a second period of three (3) weeks.
 - a. A shorter watering period may be permitted by the Agency's Authorized Representative, as determined by project conditions.
8. Discontinue watering for one (1) day prior to a second application of herbicide spraying.
 - a. Reapply straight contact herbicide in accord with manufacturer's instructions.
 - b. Do not water treated areas for a period of four (4) days minimum following application of herbicide.
 - c. Remove all desiccated weeds from the slopes to the finish grade.

3.9 PLANTING BED MULCHING

A. Mulch surfaces of planting beds and other areas indicated.

1. Organic Mulch: Apply 3-inch average thickness of organic mulch, and finish level with adjacent finish grades. Do not place mulch against plant stems.

3.10 CLEANUP AND PROTECTION

- A. During exterior planting, keep adjacent pavings and construction clean and work area in an orderly condition.
- B. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged exterior planting.

3.11 DISPOSAL

- A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION

SECTION 32 93 01

TREE PRUNING

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

- A. The Conditions of the Contract and Division 1 apply to this section as fully as if repeated herein.

1.2 SUMMARY

- A. Work Included: All labor, materials, equipment and services necessary to provide pruning of existing trees indicated to remain, or to be relocated and disposing of waste materials off the worksite.

- 1. Remove dead, diseased and injured limbs.
- 2. Balance canopy with root system distribution.
- 3. Reduce density of tree canopy as directed.
- 4. Root pruning.

- B. Related Work:

- 1. Section 01 56 39 – Temporary Tree and Plant Protection
- 2. Section 31 11 00 – Site Clearing and Grubbing
- 3. Section 32 93 00 – Landscape Planting

1.3 SUBMITTALS

- A. Comply with provisions of Section 01340 - SUBMITTALS of DIVISION 1 - GENERAL REQUIREMENTS of these Specifications.
- B. Make all submittal 30 calendar days prior to start of Work of this Section.
- C. Submit in quintuplicate 5 complete lists of landscape materials and equipment, including manufacturer's name and address, specific trade names, catalog numbers, complete with illustrations and descriptive literature and clearly mark or underline proposed items.
- D. Shop Drawings: Required for any landscape structure as may be specified hereinafter in accordance with provisions of Section 01340 in DIVISION 1 - GENERAL REQUIREMENTS.
- E. Disapprovals: Promptly resubmit for approval necessary data concerning a substitution for a disapproved item.

- F. Procurement List: Use the approved list of landscape materials and equipment for procurement without deviation unless otherwise authorized in writing by the Local City/County jurisdiction.
- G. Certification: In addition to other required certification, furnish a certificate with each delivery of bulk material, stating its source, quantity, type of material furnished and that such item or material conforms to specification requirements.
- H. Bonds: Furnish a faithful performance bond in the amount specified in the Contract Documents to cover the guarantees per Section 4.01.

1.4 QUALITY ASSURANCE

- A. Workers: Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are familiar with the specified requirements and the methods needed for proper performance of the Work of this Section. Contractor shall have a licensed arborist present on site at all times to direct root pruning.
- B. Codes and Regulations: All materials and workmanship in this Section shall comply with all applicable City, County, Federal and State Codes and Regulations. Contractor will obtain and pay for all required permits. Deliver all permits and certifications of inspection to the Local City/County Jurisdiction.

1.5 GENERAL REQUIREMENTS

- A. Approvals by the City/County and or local Jurisdiction:
 - 1. All approvals on required submittals hereinafter specified.
 - 2. All re-submittals requested by the Local City/County Jurisdiction.
- B. Inspection: Notify the Local City/County Jurisdiction at least 72 hours prior to time of the following required inspections:
 - 1. At the time of all tree pruning.
- C. Existing Utilities and Plant Materials: Protect utilities and/or plant materials not designated for removal or modification in place against damage resulting from work of this Contract. Perform any removal and/or modifications only on approval or instructions from the Local City/County Jurisdiction or in accordance with applicable provisions noted or specified on the Contract Drawings or in other sections of these Specifications. Replace damaged existing plant material with like type and size material. Determine the cost of irreplaceable plant material according to the "square inch" method as described by the council of tree and landscape appraisers "Manual for Plant Appraisers" (<https://www.isa-arbor.com/store/product/4390>) Handbook Current Edition and "Guide for Establishing Values of Trees and Other Plants" (<https://www.isa-arbor.com/Newsroom/determine-the-value-of-trees-with-the-guide-for-plant-appraisal>).
- D. Verifications of Dimensions and Quantities: Verify all scaled dimensions and quantities prior to start of work. Plant quantities noted on the Contract Drawings are

for the convenience of the Contractor only and do not limit the Contractor to those specific quantities. Furnish the quantities as may be necessary to do the specific work. Promptly notify the Local City/County Jurisdiction and/or actual job-site conditions which would affect the proper executions of the landscaping work. Do not work in areas where such discrepancies occur until further instructed by the Local City/County Jurisdiction.

PART 2 – PRODUCTS

2.1 PRUNING PAINT

- A. Waterproof, antiseptic, adhesive, elastic and free from kerosene, coal tar, creosote and other substances harmful to plants. Do not use shellac.

2.2 FUNGICIDE AND INSECTICIDE

- A. Selected by the Contractor, but acceptable by the Local City/County Jurisdiction before application.
- B. Inspect trees and surrounding areas for adverse conditions that may impede or adversely affect the Work, such as, but not limited to, overhead wires, wind conditions, and soundness and strength of tree. Notify the Local City/County Jurisdiction or its designee of any such adverse conditions. Do not proceed with pruning until the Local City/County Jurisdiction or its designee has been advised of the correction of such conditions.

PART 3 – EXECUTION

3.1 PRUNING

- A. Cut limbs and branches, as necessary, to healthy wood, in accordance with the undercut, overcut, and flush-cut technique to reduce tree canopy density as directed. Do not remove limbs of diameter greater than two inches unless directed by the Local City/County Jurisdiction. Seal wounds larger than one inch in diameter with tree wound dressing. Trim bruises back to sound bark and tight cambium, and coat with tree wound dressing. Prune tree roots with cross-section larger than one inch and which will remain exposed during excavation operations. Cut exposed roots approximately three inches below elevation of finish grade. Coat wounds with root wound dressing and wrap with wet root wrap.
- B. Engage a qualified arborist to recommend procedures to compensate for loss of roots, such as pruning of branches and stimulation of root growth. Furnish maintenance during the Contract period, and as recommended by the arborist and accepted by the Local City/County Jurisdiction. Do not allow exposed roots to dry out before permanent backfill is placed; either cover roots with earth or pack with peat moss and wrap with burlap. Water, keep moist, and temporarily support and protect roots from damage until they have been permanently relocated and covered with backfill.

3.2 INSECTICIDE

- A. Apply fungicide and insecticide if trees exhibit symptoms of being attacked. Apply in accordance with the manufacturers' printed application instructions.

3.3 GUARANTEE

- A. General: Guarantee the life of all trees for a period of one year from the date of acceptance of the work.
- B. Deficiencies: Should any deficiencies develop within the specified guarantee period, correct such deficiencies to the full satisfaction of the Local City/County Jurisdiction without added expense to the Local City/County Jurisdiction as per Section 3.5F.

3.4 FINAL CLEAN-UP

- A. Required: Upon completion of all landscape work and before final acceptance, remove all tools, surplus materials, apparatus, debris, weeds and exterminate rodents from the jobsite. leave the jobsite in a neat, clean condition, acceptable to the City Inspector. Wash, clean and leave all paved areas without stains.
- B. The use, storage and disposal of containers and equipment shall comply with pertinent Federal, State and local agency requirements.

END OF SECTION

SECTION 33 11 00

SITE WATER DISTRIBUTION UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Site water distribution systems located outside the building perimeter, extending to an existing water line or meter.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Division 22 – Plumbing.
3. Section 31 2313 - Excavation and Fill.
4. Section 31 2323 - Excavation and Fill for Utilities.
5. Section 32 0117 - Pavement Repair.
6. Section 32 1313 - Site Concrete Work.
7. Section 33 3000 - Site Sanitary Sewer Utilities.

1.02 SUBMITTALS

- A. Shop Drawings: Submit site plan indicating locations of lines, valves, and related appurtenances.
- B. Product Data: Manufacturer's catalog data for materials. Include technical data for accessories, gaskets, joints and couplings.
- C. Certificates: Certificates attesting that tests set forth in referenced publications have been performed, and the performance requirements have been satisfied.

1.03 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:

1. American National Standards Institute (ANSI):
 - a. ANSI H23.1 - Seamless Copper Water Tube.
2. NSF International (NSF):

- a. ANSI/NSF 61 Drinking Water System Components – Health Effects.
- b. ANSI/NSF 372 Drinking Water System Components – Lead Content.
- 3. American Society of Mechanical Engineers (ASME):
 - a. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
 - b. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
 - c. ASME B16.26 - Cast Copper Alloy Fitting for Flared Copper Tubes.
 - d. ASME B16.51 - Copper and Copper Alloy Press-Connect Pressure Fittings.
- 4. American Society for Testing and Material (ASTM) International:
 - a. ASTM A36 – Standard Specification for Carbon Structural Steel.
 - b. ASTM A240 – Standard Specification for chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - c. ASTM A312 – Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
 - d. ASTM A536 - Standard Specification for Ductile Iron Castings.
 - e. ASTM B61 - Standard Specification for Steam or Valve Bronze Castings.
 - f. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
 - g. ASTM B75 - Standard Specification for Seamless Copper Tube.
 - h. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
 - i. ASTM B152 – Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar.
 - j. ASTM 17 – Standard Specifications for Copper Alloy Sand Castings for General Applications.
 - k. ASTM D1784 – Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - l. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.

- m. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
 - n. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 - o. ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
 - p. ASTM D3350 - Standard Specification for Polyethylene Plastics and Fittings Materials.
 - q. ASTM F2620 - Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.
 - r. ASTM F2206 - Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE).
 - s. ASTM F477 - Standard Specification for Elastomeric Seals for Joining Plastic Pipe.
 - t. ASTM F714 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter.
5. American Water Works Association (AWWA):
- a. AWWA C104/A21.4 - Cement-Mortar Lining For Ductile-Iron Pipe and Fittings.
 - b. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings
 - c. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - d. AWWA C115/A21.15 - Standard for Flanged Ductile-Iron Pipe with Threaded Flanges.
 - e. AWWA C153/A21.53 – American National Standard for Ductile-Iron Compact Fittings for Water Service
 - f. AWWA C207 – Steel Pipe Flanges for Waterworks Service Sizes 4 In. Through 144 In.
 - g. AWWA C500 - Metal Seated Gate Valves for Water Supply Service.
 - h. AWWA C503 - Wet- Barrel Fire Hydrants.
 - i. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 inches through 24 inches (50-mm through 600-mm) NPS.

- j. AWWA C510-89 - Standard for Double Check Valve Backflow-Prevention Assembly.
- k. AWWA C511 - Reduced-Pressure Principal Backflow-Prevention Assembly.
- l. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
- m. AWWA C800 - Underground Service Line valves and Fittings.
- n. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings 4 In. Through 12 In., for Water Transmission and Distribution.
- o. AWWA C901 – Polyethylene (PE) Pressure Pipe and Tubing, 3/4 In. Through 3 In., for Water Service.
- p. AWWA M23 - PVC Pipe - Design and Installation.
- q. AWWA M55 - PE Pipe - Design and Installation.
- 6. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry:
 - a. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.
- 7. Uni-Bell PVC Pipe Association (UBPPA):
 - a. UBPPA UNI-PUB-09 - Installation Guide for Gasketed-Joint PVC Pressure Pipe (C900).
- 8. Underwriters Laboratories Inc. (UL):
 - a. UL 246 – Standard for Hydrants for Fire-Protection Service.
 - b. UL 262 – Standard for Gate Valves for Fire-Protection Service.
 - c. UL 312 – Standard for Check Valves for Fire-Protection Service.
- 9. National Pollutant Discharge Eliminations System (NPDES):
 - a. Comply with storm water requirements of general permit for storm water discharges when flushing pipe systems including storm drains and maintaining logs.
- 10. Plastic Pipe Institute (PPI):
 - a. TN-38 – Bolt Torque for Polyethylene Flanged Joints.
 - b. TR-4 – Technical Report requirements of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure

Design Basis (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipes.

- c. TR-33 – Technical Report for Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe.
- B. Provide valves from the same manufacturer.
- C. Manufacturer of plumbing products must be third-party certified to ANSI/NSF Standard 61, Section 9 certification, and ANSI/NSF 372 to demonstrate compliance with the federal requirements for lead contribution to drinking water, the Safe Drinking Water Act SDWA, and the California Health and Safety Code Section 116875. No pipe, pipe fitting, or any other fitting or fixture intended to convey or dispose water for human consumption for drinking or cooking is allowed in the domestic plumbing system, if they do not meet the low lead definition of Health and Safety Code 116875. Weighted average lead content of the wetted surface area of pipes, fittings and fixtures may not exceed 0.25 percent.
- D. Qualifications of Manufacturer: Products used in the Work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production as reviewed by the ARCHITECT.

1.04 PRODUCT HANDLING

- A. Store items above ground on platforms, skids, or other required supports.
- B. Protect materials from direct sunlight.
- C. Protect coating and linings on piping, fittings, and accessories from damage. Repair and/or replace damaged coatings or linings.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Pipes, Fittings, and Joints:

P-1: Underground water service pipe sizes up to 3-inch shall be Copper water tubing, Type K hard, ANSI H23.1, ASTM B88, IAPMO IS. Manufacturer: Mueller, Cerro Brass, Cambridge-Lee, Halstead, or equal.

An approved protective wrap shall be used to completely isolate and protect underground copper tubing and extend past the surface a minimum 12-inch. The excess wrapping shall be trimmed down and taped to copper tubing with 10 mill PVC pipe tape at grade level of concrete or asphalt.

PF-1a: Copper Press-Connect pressure fittings, comply with ASME B16.51 with Ethylene Propylene Diene Monomer, EPDM O-Ring Seal in each end. Fittings with the sizes of 2-1/2" and larger shall have cross-section Grab Rings and separation rings.

Manufacturer: Viega, Mueller Industries, Apollo, or equal.

PF-1b: Wrought Copper - solder type ASME B 16.22.

Manufacturer: Mueller Brass, Nibco, Lee Brass, or equal.

PF-1c: Grooved end type— ASTM B75 or ASTM B152 and ASME B16.22 Wrought Copper, bronze sand casting per ASTM B584 copper alloy CDA 836 per ASME B16.18. Couplings shall be CTS style 606 supplied with angle pattern bolt pads for rigidity, coated with copper coated alkyd enamel. Gaskets shall be pre-lubricated Flush seal type.

Manufacturer: Victaulic, or equal.

P-2: Underground water service pipe sizes up to 3-inch shall be high density polyethylene pipe (HDPE) with tracer wire. Pipe and fitting system shall be pressure class 333 (DR7). All material shall be manufactured from a PE 4710 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material shall meet the specifications of ASTM D3350 with a minimum cell classification of 445474C. HDPE pipe and fittings shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. HDPE products shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.

Pipe sizes smaller than 3" shall be manufactured to the dimensional requirements listed in ASTM D3035, and 3" Pipes shall have a manufacturing standard of ASTM F714. Pipes and fittings shall meet AWWA C901 and shall be listed as meeting NSF-61.

Installer shall be certified by manufacturer for HDPE pipe and joint installation.

Manufacturer: ISCO, JM Eagle or equal.

PF-2a: Butt Fusion HDPE Fittings shall meet the following requirement:

- a. Molded fittings shall comply with the requirements of ASTM D 3261.
- b. All fabricated elbows, tees, reducing tees and end caps shall be produced and meet the requirements of ASTM F2206.
- c. Socket fittings shall meet ASTM D 2683.
- d. Installer shall be certified by manufacturer for this type of joint installation.

Manufacturer: ISCO, JM Eagle or equal.

PF-2b: Bolted Connections- Flanges and MJ Adapters shall be fused onto the pipe and have a minimum pressure rating equal to or greater than the pipe and shall meet the following requirement:

- a. Metallic back-up rings (Van-Stone style lap joint flanges), shall have a radius on the inside diameter of the bore so as to be compatible with HDPE Flanges. Back up rings shall have bolt pattern that will mate with AWWA C207 Class D (generically known as 150 pound patterns).

- b. Flange assemblies shall be assembled and torqued according to PPI TN-38.
- c. Installer shall be certified by manufacturer for this type of joint installation.

P-3: Underground water service pipe sizes 4-inch and larger shall be C900 water service pipe material complying with AWWA C900, and ASTM D1784 Cell Class 12454B with tracer wire, NSF and UL listed. Piping shall be plain end or gasket bell end, pressure class 305 (DR14) with cast iron pipe equivalent outside diameter.

PF-3: Fire Water Service, Domestic Water and Irrigation Service Line Fittings, Joints and Jointing Materials shall be Ductile-iron with mechanical joints conforming to AWWA C110/A21.10 or AWWA C153/A21.53, C900 compatible, and shall have cement mortar lining conforming to AWWA C104/A21.4, standard thickness unless otherwise indicated on Drawings.

- a. Pipe joints shall be push on as specified in ASTM D3139.
- b. Joints between pipe and metal fittings, valves, and other accessories shall be mechanical joints as specified in AWWA C111/A21.11.
- c. Provide each joint connection with an elastomeric gasket suitable for the bell or coupling installation.
- d. Gaskets for push on joints for pipe shall conform to ASTM F477.
- e. Gaskets for push on joints and compression type joints or mechanical joints for connections between pipes and metal fittings, valves, and other accessories shall be as specified in AWWA C111/A21.11.
- f. Sleeve-type mechanically coupled joints may be provided instead of push-on joints on plain-end PVC plastic joints. Comply with requirements of ASTM D3139.
- g. Comply with installation guide UBPPA UNI-PUB-09.

Manufacturer: JM Eagle, Diamond Plastics, North American Pipe, or equal.

P-4: Aboveground water service pipe shall be Type 316L Stainless Steel, Schedule 40 water pipe, marked with manufacturer's identification and fittings. Manufacturer's representative shall instruct installers and certify them for joint installation. Piping system shall be provided with a five-year manufacturer's material warranty.

Manufacturer: Viega, or equal.

PF-4: Type 316L Stainless Steel, Schedule 40 Press Fittings. For water service piping systems, provide with EPDM seals. Manufacturer's representative shall instruct installers and certify them for joint installation.

Manufacturer: Viega, or equal.

D. Gates Valves for PVC:

1. Non-rising stem type with resilient wedge gates or iron body bronze wedge gates and mechanical joint ends conform to AWWA C500.
2. Non-rising stem type with mechanical joints ends shall conform to AWWA C509.
3. Valves designed for a working pressure of 175 PSI shall be inside-screw type with operating nut, and resilient wedge type gate. Valve shall be provided with mechanical joints as required for the pipe to which it is intended to connect.
4. Valves with UL listing of 262 shall conform to AWWA C500. Valves shall open by counter-clockwise rotation of valve stem.
5. Stuffing boxes shall be provided with O-ring stem seals and shall be bolted and constructed to permit easy removal of parts for repair.
6. Sleeve type mechanical couplings may be provided instead of mechanical and push on joint ends.
7. Valve ends and gaskets for connection to sleeve type mechanical couplings shall conform to specified requirements for the joint or coupling.

E. Gate Valves in Valve Pits:

1. Outside screw and yoke rising stem type valves with resilient wedge gates and flanged ends shall conform to AWWA C500.
2. Outside screw and yoke rising stem type valves with flanged ends shall conform to AWWA C509.
3. Outside screw and yoke type Valves with double disc gates or split-wedge type gate and flanged ended ends shall be designed for 175 psi and conform to UL 262.
4. Provide valves with hand wheels that open by counterclockwise rotation of the valve stem.
5. Stuffing boxes shall be provided with O-ring stem seals and shall be bolted and constructed to permit easy removal of parts for repair.

F. Check Valves for PVC:

1. Valves shall be swing-check type conforming to AWWA C508 or UL 312.

2. Valves shall be provided with cast iron or steel body and cover, flanged ends and clear port opening.
 3. Valves shall be designed for a working pressure of 175 PSI.
- G. Fire Hydrants:
1. Before procurement, verify approval issued by the County of Los Angeles or Fire Department having jurisdiction.
 2. Hydrants shall be wet barrel types conforming to AWWA C503 or UL 246.
 3. Only 1¾-inch pentagonal nuts are to be provided on stems and protective caps.
 4. Specified hydrants:
 - a. Clow/Rich # 850 or 860
 - b. James Jones #J3700 Fluted Spool
 - c. Equal.
- H. Valve Boxes: 14 ¾-inch by 20-inch by 12-inch cast concrete with cast iron, traffic grade cover marked "WATER" (for use over water valves).
1. Brooks 36-H MB with No. 36-T cast iron cover EISEL 363.5, or equal.
- I. Mechanical Thrust Restraint:
1. Restraint shall be incorporated into the follower gland.
 2. Restraint shall consist of individually actuated wedges that increase resistance to pull out as internal pressure or external forces increase.
 3. Gland shall be ductile iron conforming to ASTM A536.
 4. Provide twist off nuts and tee-head bolts of the same size to ensure proper actuating of restraint devices.
 5. Restraining device shall be provided with pressure rating equal to that of the pipe on which it is installed.
 6. Restraining gland shall be UL listed.
 7. Mechanical thrust restraint devices shall be EBAA Iron "Megalug" or equal.
- J. Restraint Device Adapters:
1. Restrained flange adapters shall be provided instead of threaded or welded flange spool pieces on plain end of ductile iron or PVC pipe.

2. Flange adapters shall be manufactured of ductile iron conforming to ASTM A536 and be provided with flange bolt circles compatible with AWWA C115/A21.15.
 3. Restraint of flange adapter shall consist of a multiple number of individually actuated gripping wedges to maximize restraint capability.
 4. Torque limiting actuating screws shall be provided to insure proper initial set of gripping wedges.
 5. Flange adapter shall be capable of deflection during assembly or permit lengths of pipe to be field cut to allow at least 0.6 inch of gap between end of pipe and mating flange without affecting integrity of seal.
 6. Flange adapter shall be provided with a safety factor of at least 2:1 for rated pressure.
 7. Restraint device adapters shall be EBAA Iron "Megaflange", or equal.
- K. Tracer Wire for Nonmetallic Pipes: Tracer wires shall be continuous solid copper wire type THWN, 12 AWG gauge, with heat and moisture resistance insulation. Blue plastic covered for domestic water and red for fire sprinkler. (Aluminum wire is prohibited). Provide in sufficient length to be continuous over each installed section of nonmetallic pipe.
- L. Pipe markers shall be a concrete plaque inscribed with the word "WATER."
- M. Water Service Line Materials:
1. Water Service Line Piping Material: Refer to article 2.01.A within this section.
 2. Water Service Line Appurtenances:
 - a. Corporation stops shall be ground key type; manufactured of bronze conforming to ASTM B61 or ASTM B62; and suitable for the working pressure of the system. Ends shall be suitable for solder-joint or flared tube compression type joint connection. Threaded ends for inlet and outlet of corporation stops shall conform to AWWA C800; coupling nut for connection to flared copper tubing and shall conform to ASME B16.26.
 - b. Goosenecks shall be type K copper tubing. Joint ends for goosenecks shall be as required for connecting to corporation stop and service line. Where multiple gooseneck connections are required for individual service, connect goosenecks to service line through brass or bronze branch connection; the total clear area of branches shall be at least equal to clear area of service line. Length of goosenecks shall be as indicated or required.
 - c. Curb or service stops shall be ground key, round way, inverted key type; bronze, conforming to ASTM B61 or ASTM B62; and rated at 150 psi. Ends shall be as required for connection to service piping. Arrow

shall be cast into body of curb or service stop indicating direction of flow.

- d. Gate valves 2.5-inch and larger shall be MSS SP-80, Class 150, solid wedge, or resilient wedge gate, and non-rising stem. Valves shall be provided with flanged end connections. Provide hand wheel operators if easily accessible. Provide operating nut if inside a vault, pit or valve box.
 - e. Gate valves in valve pits 2-inch, and smaller shall be MSS SP-80, Class 150, bronze, solid wedge, inside screw, rising stem. Valves shall be provided with flanged end connections or threaded end connections with union on one side of valve and hand wheel operator.
 - f. Valve boxes shall be provided at each gate valve installed underground. Valve boxes shall be a size suitable for valve on which it is installed.
- N. Water meter will be installed by water purveyor for the area, unless noted otherwise.
- O. Strainers:
- STR-1 Description: Wye type with Monel or Stainless Steel strainer cylinder (manufacturer's standard mesh), and gasketed machine strainer cap. Where indicated on Drawings, provide with valved (globe valve) blow out piping, same size as blow out plug:
- 2-inch and smaller: C.M. Bailey #100-A, bronze, 250 pound, or ductile iron with fusion bonded epoxy coating.
- 2 ½-inch and larger: Watts 77F-DI-FDA-125 pound, or other ductile iron fusion bonded epoxy coated flanged strainer, conforming to ASTM A312 for the strainer body, and ASTM A240 for the stainless steel strainer element. (No iron body strainer shall be used on potable water that is not fusion bonded epoxy coated inside and out.)
- C.M.Bailey, Armstrong, Wilkins, Watts, or equal.
- STR-2 "Y" pattern, cast iron bodies, 125 psi, Monel screen 16 square. mesh. Open area at least twice the cross-sectional area of IPS pipe in which strainer is installed and may be woven wire or perforated type. Screwed ends for sizes up to 2-inch, flanged ends for 2 ½-inch and larger perforations, in accordance with the following:
- Bailey #100, Armstrong, Rp & C , Keckley, or equal.
- STR-3 Bucket type, flange, semi-steel body, 125 psi, stainless steel screen with 1/8 inch diameter perforations (mounted above grade for water service). All sizes, for lines serving fire sprinkler risers:
- Bailey #1, Zurn 150 Series, Rp 7 C, Watts 97fb-Fsfe, or equal.

STR-42" and larger: Watts 077-F-SS Stainless steel flange type strainer, or equal conforming to ASTM A312 for strainer body, ASTM A240 for the SS strainer element and ASTM A36 for base flange material.

P. Backflow Preventer Assemblies:

1. Assembly shall be provided with flanged connections, ductile iron with fusion bonded epoxy coated construction, bronze, or stainless steel.
2. Backflow preventer shall be suitable for cold water working pressure of 175 psi.
3. Internal parts shall be designed for replacement without removing valves from line.
4. Double check backflow preventer assembly shall consist of two independently acting spring cam or poppet style check valves, 2 shut-off valves and 4 test cocks. Check valve shall be designed to provide drip tight closure against reverse flow, low pressure drop at maximum flow capacity. Spring-loaded checks shall cause valve to seal against a higher inlet pressure than outlet pressure when there is no flow.
5. Double check backflow preventer assembly shall meet AWWA Standard C510-89. Assembly shall be Ames 2000ss, Febco 850, Watts 709, Wilkins 350, or equal.
6. Reduced pressure backflow preventer assembly shall consist of two check valves located between two shut-off valves with an area of reduced pressure between two check valves and a relief device arranged to discharge to atmosphere.
 - a. Comply with AWWA Standard C511.
 - b. Fluctuation in piping pressure shall not cause cycling. Backflow preventer shall automatically maintain low pressure zone to positively prevent backflow of water into system. Assembly shall automatically indicated failure of any part vital to backflow prevention by the continuous discharge relief device.
 - c. Reduced pressure backflow preventer assembly shall be Cla-Val Model RP-4, or equal.
7. Backflow prevention assemblies (devices), shall be tested and certified by a certified backflow tester, and a test report shall be provided to the water agency having jurisdiction. Testing shall be performed in the presence of the Project Inspector.

PART 3 - EXECUTION

3.01 EXCAVATION, BACKFILLING AND COMPACTING

- A. Conform to requirements in Section 31 2323 - Excavation and Fill for Utilities or Section 31 2313 - Excavation and Fill.

3.02 PIPE INSTALLATION

- A. Project site water lines shall terminate approximately 5 feet from buildings, unless otherwise indicated on Drawings. Temporarily cap or plug terminals for future connection to building.

3.03 CLEARANCES OF WATER LINE

- A. Building or Structures: Two feet.
- B. Parallel to Sewer Line:
 - 1. Water line 4-inch or less in diameter shall not be installed in a common trench with the building sanitary drain unless the bottom of the water line is at least 12 inches above the top of the building sanitary drain or where the water line is installed on a solid shelf excavated on one side of the common trench with a minimum clear horizontal distance of 12 inches from the building sanitary drain.
 - 2. Water lines 6-inch and larger in diameter shall be separated from the Project site sanitary sewer, receiving more than one building sanitary drain or acid pipeline, in accordance with the requirement of the State of California, Human and Welfare Agency, Department of Health Services.
- C. Crossing Sewer Line:
 - 1. A water line shall be separated from sanitary sewer in accordance with the requirements of the State of California Administrative Code, Title 22, Section 64630(e)(2).
 - 2. Install water line a minimum of 12 inches clear, above or below a sanitary sewer.
 - 3. A water line 6-inch or greater in diameter, crossing under a Project site sanitary sewer line, shall be installed with joints located at least 10 feet away from each side of the sanitary sewer line.
 - 4. A water line 6-inch or greater in diameter, crossing over a Project site sanitary sewer line, shall be installed with joints located at least 4 feet away from each side of a purple pipe or sanitary sewer line.
- D. Install water lines no closer than 10 feet horizontally clear from the edge of sewage leach fields, seepage pits, and septic tanks.

3.04 PIPE INSTALLATION AND JOINING

- A. Install all piping and fitting systems according to the manufacturer requirement.
- B. Remove fins and burrs from pipe and fittings.

- C. Clean piping, fitting, valves, and accessories before installing. Maintain items in a clean condition.
- D. Provide proper facilities for lowering sections of pipe into trenches. Do not drop into piping, fittings, or other materials into trenches. Accurately cut pipe and install without springing or forcing. Replace any piping or fitting that does not provide sufficient space for proper installation of joining material.
- E. Blocking or wedging between bells and spigots is not permitted. Install bell and spigot pipe with bell end pointing in the direction of flow.
- F. Install piping to the lines and grades indicated or required. Low points and dips are not permitted. Support piping at proper elevation and grade with secure and uniform supports. Wood support blocking is not permitted. Where sand cement slurry will not be furnished for backfill, install piping so that full length of each section of pipe and each fitting will solidly rest on pipe bedding. Excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where indicated or required for installation. Provide proper allowances and devices for expansion and contraction of piping and systems.
- G. Maintain trenches free of standing water until pipe joints have been installed.
- H. At the end of each day close open ends of pipe with temporary caps of the same material as the pipe.
- I. Do not install piping when trench or weather conditions prevent proper installation.

3.05 INSTALLATION OF TRACER WIRE AND PIPE MARKERS

- A. Tracer Wire: Install continuous length of tracer wire for full length of each run of nonmetallic pipe. Fasten wire to top of pipe in such a manner that it will not be displaced during construction operations. Wire shall be fastened to pipe at not greater than 20-foot intervals. Wire shall terminate above finished grade with a 12-inch lead taped around each riser. Provide a tracer wire to grade under a permanent marker where straight-line transitions of metallic to non-metallic pipe are installed.
- B. Underground Pipe Markers: Provide markers at grade where non-metallic pipe is installed and for each horizontal change in direction.

3.06 CONNECTIONS TO EXISTING WATER LINES

- A. After Project Inspector has inspected installation, perform connections to servicing water lines. Schedule service shutdown for connecting new system at a time causing minimum disruption.

3.07 INSTALLATION OF HDPE WATER SERVICE LINE

- A. All HDPE pipe and fittings shall be cut, joined, and installed in accordance with the manufacturer's recommendations. Joining, and laying of polyethylene pipe shall be accomplished by personnel experienced and certified in working with polyethylene pipe systems.

B. Jointing:

1. All HDPE pipe shall be joined to itself by the heat fusion process which produces homogeneous, seal, leak tight joints. Tie-ins between sections of HDPE pipe shall be made by butt fusion whenever possible.
2. The pipe shall be joined by the butt fusion procedure outlined in ASTM F 2620 or PPI TR-33. A record or certificate of training for the fusion operator must be provided that documents training to the fundamentals of ASTM F 2620.
3. The employer of the fusion machine operator is responsible for the fusion joint quality of the fusion weld made by that individual. The employer is responsible for documenting all training and qualification records for that individual, including compliance to any code requirements for fusion/bonder operators.
4. All HDPE fusion equipment operators shall be qualified to the procedure used to perform pipe joining. Fusion equipment operators shall have current, formal training on all fusion equipment employed on the project approved by manufacturer. Training received more than two years prior to operation with no evidence of activity within the past 6 months shall not be considered current.

C. Installation:

1. Buried HDPE pipe and fittings shall be installed in accordance with AWWA Manual of Water Supply Practices M55 Chapter 8. The Design Window identified in AWWA M55 Chapter 5 shall be considered acceptable design and installation conditions.
2. Unless required by design documents, no thrust blocks shall be placed in the HDPE pipe system since the fused system is fully restrained.
3. All appurtenances (tees, elbows, services, valves, etc.), must be independently supported and shall not rely on the pipeline and its connections for this support. Excessive stresses may be encountered when appurtenances are inadequately supported.

3.08 INSTALLATION OF C900 PLASTIC WATER SERVICE LINE

- A. Unless otherwise indicated, install pipe and fittings as specified and in accordance with UBPPA UNI-B-09 and AWWA M23, Chapter 7, "Installation".

B. Jointing:

1. Provide push on joints with elastomeric gaskets specified for this type of joint, furnishing either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push on joint connections, provide pipe with push on joint ends furnished with factory installed bevel; for push on joint connections to metal fittings, valves and other accessories, square cut spigot end off pipe end.

2. Provide push on joint lubricant recommended by manufacturer.
 3. Install push on joints for pipe-to-pipe connections in accordance with UBPPA UNI-PUB-09 and AWWA M23, Chapter 7, "Installation."
 4. Install push on joints for connection to fittings, valves, and other accessories in accordance with requirements of UBPPA UNI-PUB-09 and with applicable requirements of AWWA C600.
 5. Compression-type joints/mechanical-joints with gaskets, glands, bolts, nuts and internal stiffeners shall be installed in accordance with the requirements of UBPPA UNI-PUB-09 and AWWA C600 and Appendix A to AWWA C 111/A21.11.
 - a. Square cut spigot off end of pipe for compression-type joint/mechanical-joint connections and do not re-bevel.
 6. Sleeve-type mechanical couplings shall be provided in strict accordance with coupling manufacturer's recommendations using internal stiffeners as specified for compression-type joints.
- C. Provide mechanical thrust restraint devices for anchorage and piping unless thrust blocks are indicated on the Drawings. Thrust blocks shall be installed in accordance with the requirements of UBPPA UNI-PUB-09 except that size and location of blocks shall be as indicated. Thrust blocks shall be provided as specified in Section 32 1313 - Site Concrete Work.

3.09 INSTALLATION OF VALVES

- B. Provide gate valves conforming to AWWA C500 and UL 262 in accordance with AWWA C600 for valve and fitting installation and with recommendations of AWWA C500 Appendix "Installation, Operation, and Maintenance of Gate Valves".
- C. Provide gate valves conforming to AWWA C600 in accordance with AWWA C509 for valve and fitting installation and with recommendations of AWWA C500 Appendix "Installation, Operation, and Maintenance of Gate Valves".
- D. Provide gate valves on PVC water service lines in accordance with AWWA M23 Chapter 7, "Installation."
- E. Provide check valves and fittings in accordance with applicable requirements of AWWA C600 unless noted otherwise on the Drawings.
- F. Provide gate and check valve joints as specified for the type of joints between pipe and fittings.

3.10 INSTALLATION OF HYDRANTS

- A. Install hydrants according to requirements of AWWA C600 for hydrant installation and as indicated. Provide joints as specified for the type of joints between pipe and fittings.

- B. Install hydrant with a 6-inch key gate valve between 4 and 10 feet from the hydrant.

3.11 INSTALLATION OF BACKFLOW PREVENTERS

- A. Install reduced pressure backflow preventers to comply with RULE 16D of LADWP in the jurisdictional boundaries of Los Angeles Department of Water and Power.

3.12 INSTALLATION OF STRAINERS:

- A. Strainers shall be installed on each water line downstream of the meter, above grade at the pressure regulating station. When a pressure regulating station (assembly) is not provided, "wye" type flange strainer shall be provided, with a shut off valve on the inlet and the outlet side.
- B. If the water line is serving fire sprinkler risers or hydrants, then an approved fire service strainer shall be used: Watts 97DB-FSFE, or equal.

3.13 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. For complete requirement and procedure refer to section 22 1000, article 3.12.

3.14 ELECTROLYSIS PREVENTION

- A. A minimum 6-inch long brass nipple shall be installed at locations specified or as required. Flanges shall be provided with a complete insulating component consisting of; gasket bolt sleeves and bolt washers. Dielectric insulators shall be installed at locations indicated or as required. Dielectric fittings are prohibited.
- B. Where steel or cast iron below grade connects to copper or brass piping above grade, the transition from steel or cast iron pipe to copper or brass pipe shall be installed in an above grade accessible location.
- C. Underground connections between dissimilar metals shall be in accessible yard boxes.
- D. Above ground dielectric connections shall be exposed.

3.15 ABANDONING WATER LINES AND STRUCTURES

- A. Water lines and appurtenances to be abandoned in place shall be cut and removed from areas where new Work is being installed.
- B. Cap or plug abandoned existing drain lines below grade in a yard box and according to CBC.

3.16 TESTS AND INSPECTIONS

- A. Provide labor, equipment, materials, test equipment and incidentals required for performing required field tests.
- B. Tests shall not be performed for five days after concrete thrust blocks have been installed.

- C. Testing Procedure: Water service lines shall be tested in accordance with applicable specified standard.
 - 1. Test water service lines in accordance with applicable requirements of AWWA C600. No leakage is permitted.
 - 2. Pressure testing: Before pressure test, fill portion of piping being tested with water for a minimum of 24 hours. Provide hydrostatic pressure of at least 50 psi greater than the maximum working pressure of tested system, but no less than 200 psi hydrostatic test pressure for system piping of 2-inch in diameter and larger. Provide and maintain hydrostatic test pressure for at least two hours to ensure no leakage of any portion of piping or appurtenances under pressure test.

3.17 CLEANING

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.18 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 33 30 00

SITE SANITARY SEWER UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Building Sanitary Sewer Lateral.
2. Closed-circuit television inspection of sewer laterals.

B. Related Requirements:

1. Section 31 2313 - Excavation and Fill.
2. Section 31 2323 - Excavation and Fill for Utilities.
3. Section 32 0117 - Pavement Repair.
4. Section 32 1313 - Site Concrete Work.

1.02 SUBMITTALS

- A. Shop Drawings: Submit site plan denoting locations of lines, valves, and appurtenances.
- B. Product Data: Manufacturer's catalog data for materials. Include technical data for accessories, gaskets, joints and couplings.
- C. Certificates: Certificates attesting that tests set forth in referenced publication have been performed and the results required by design have been met.
- D. Closeout Submittal: Submit three DVD's and/or thumb drive of Closed-circuit television inspections performed. Include the following information:
 1. Electronic Media Recordings: Visual and audio record of the entire length of pipe. For existing laterals identify problem areas, such as roots, cracks, fractures, broken pipe, and other unusual conditions found.
 2. Digital Photographs of the pipe condition, connections, points of interest and defects found. Indicate distance of defects to a point of reference such as face of building or mainline.
 3. Inspection Log: Provide written report including:
 - a. Date and time of inspection.

- b. Name of School, Project, CONTRACTOR, and operator name.
- c. Location, material and size of pipe.
- d. Description of defects found.

1.03 QUALITY ASSURANCE

- A. Comply with the following as a minimum requirement:
 - 1. Standard Specifications for Public Works construction, current edition.
 - 2. California Plumbing Code, CPC, current edition.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Pipeline: Building or Project Site Sanitary Sewer and Vent: Minimum 5 feet away from building boundaries. For piping within 5 feet from building boundaries, and interior piping refer to Division 22 plumbing sections.
 - 1. Cast iron soil pipe: Hubless, service weight, ASTM A888, CISPI 301, conforming to CISPI 310 and installed in accordance to IAPMO IS 6. Manufacturer: American Foundry, Tyler, or AB&I, or equal.
 - a. Cast iron soil coupling: Hubless, heavy-duty with neoprene gaskets, stainless steel corrugated shields, and 4 bands of stainless-steel clamps. IAPMO, ASTM C564 and CISPI 310. Manufacturer: American Foundry, Mission Rubber Company, Tyler, or equal.
 - 2. PVC (Poly Vinyl Chloride) Schedule 40 DWV Pipe, Conforming to ASTM D2665, ASTM F794, and ASTM F1866. Installer of PVC Schedule 40 DWV piping system shall carry ASTM D2855 and ASME B31.3 qualification. Installer shall provide proof of these qualifications to IOR prior to commencing work. Manufacturer: Charlotte pipe and foundry, Spears Manufacturing Company, Harvel Plastics Inc., or equal.
 - a. PVC primer and solvent for chemical weld of pipe and fittings shall be as recommended by pipe manufacturer. Containers for solvent and primer shall be clearly marked with manufacturer's data. Solvent and primer shall not be more than one year old. The safety placards must be visible. Blue or red hot glue shall not be used.
 - 1) Primer: Weld-On P-70 by IPS, Conforming to ASTM F656.
 - 2) Cement: Weld-On 711 (gray) by IPS, Conforming to ASTM D2564.

3. Vitrified clay extra strength piping with plain ends. Comply with ASTM C700. Install with mechanical compression couplings. Joints shall comply with ASTM C425. Installation shall be in accordance with ASTM C12.

Manufacturer: Mission Clay Products, or equal.

4. Acid waste and vent pipeline from building to Sampling Box: Refer to Division 22 for corrosive waste and vent piping.

B. Cleanout Assemblies: Cleanout plug shall be line size.

1. In covered concrete-paved floors: Iron body with UPC recognized plug, top, and adjustable sleeve, cut-off ferrule, polished brass/nickel/bronze, and secured Scoriated cover:

a. Square:

J.R.SMITH	ZURN	JOSAM	OR EQUAL
4053	Z1400-SZ	57008-Z-1-SQ	

b. Round:

J.R.SMITH	ZURN	WADE	JOSAM	OR EQUAL
4033	Z1400-BZ	W-6000	57008-Z-1	

2. Outside covered concrete-paved floors: Secured cover, extra heavy-duty, adjustable sleeve, cut-off ferrule, UPC recognized brass type plug, scoriated tractor type cover:

J.R.SMITH	ZURN	OR EQUAL
4233	Z1402-HD	

3. In yard boxes: Raised threaded head brass plug and Cast Iron Body Cleanout.

J.R.SMITH	ZURN	WADE	JOSAM	OR EQUAL
		8590A		

C. Yard Boxes: 14 1/2-inch by 19 3/4-inch by 12-inch, cast concrete, with cast-iron hinged locking traffic cover with the word "SEWER," embossed on the cover in one inch high upper case lettering.

BROOKS No. 36-HFL Assembly with cast iron hinged locking cover	OR EQUAL

D. Concrete, Mortar and Related Materials: Conform to Section 32 1313 - Site Concrete Work, unless noted otherwise.

E. Metal Covers, Frames and Accessories:

1. Conform to Section 206 – Miscellaneous Metal Items of the Standard Specifications for Public Works Construction.
2. Metal Covers and Frames: Vandal-resistant design and construction.
3. Hot-dip galvanize steel parts after fabrication and prior to assembly in accordance with Section 210 – Paint and Protective Coating of the Standard Specifications for Public Works Construction.

- F. Bedding Materials: Conform to the requirements of Section 31 2313 - Excavation and Fill or Section 31 2323 - Excavation and Fill for Utilities, as required.

PART 3 – EXECUTION

3.01 SANITARY SEWER INSTALLATION

- A. Install sanitary sewers in a uniform alignment and slope to the point of connection as indicated. Before trench excavation, verify size, material, depth, and location of the point of connection. Minimum depth of below grade sewer lines shall be 24 inches to centerline of pipe
- B. Pipe slope shall not be less than $\frac{1}{4}$ inch per foot or 2 percent unless pipe inverts are indicated. Where invert elevations are indicated, install pipe at a uniform slope between inverts.
- C. Join pipes and fittings as recommended by the manufacturer.
- D. PVC schedule 40 DWV pipe and fittings shall be solvent welded. PVC pipe ends shall be cut ninety (90) degrees and Beveled from 10°-15° with a proper beveling tool, cleaned and cleared of cutting burrs prior to cementing. Use approved reaming tool. Pipe ends shall be wiped clean and free of dirt, moisture, oil, and other foreign material with a rag. Primer shall be applied until the surface of the pipe and fitting is softened. Cement shall be applied with a light coat on the inside of the fitting and two heavier coats on the outside of the pipe. Pipe shall be inserted into the fitting and given a quarter turn while inserting if possible to help seat the cement while both the inside socket surface and outside surface of pipe are wet with solvent cement. Hold joint in place and undisturbed for 1 minute after assembly. Excess cement shall be wiped from the outside of the pipe.

3.02 CLEARANCE OF SANITARY SEWERS

- A. Buildings or Structures: Two feet.
- B. Parallel to Water Line:
1. Building sanitary drain, is not permitted to be installed in a common trench with a potable water line unless the bottom of the water line is at least 12 inches above the top of the sanitary sewer.
 2. In addition, the potable water line shall be installed on a solid shelf excavated on one side of the common trench with a minimum clear horizontal distance of 12 inches from the sanitary sewer or building sanitary drain.
 3. Project site sanitary sewer, receiving more than one building sanitary drain or acid pipeline, shall be separated from a potable water line in accordance with the requirements of the California Health, and Human Services Agency: Department of Public Health.
- C. Crossing Water Line:

1. Building sanitary drain shall be installed a minimum of 12 inches below the potable water line.
2. Project site sanitary sewer shall be separated from the potable water main in accordance with the requirements of the State of California Administrative Code, Title 22, Section 64630(e)(2).

3.03 MANHOLES

- A. Provide manholes in accordance with the Standard Plans for Public Works Construction, unless otherwise indicated.
- B. Adjust manholes in accordance with the sub-section 302-5.8 Manholes (and other structures) of the Standard Specifications for Public Works Construction.

3.04 CLEANOUTS

- A. Provide cleanout at the upper terminal for each sanitary pipeline, at intervals not exceeding 100 feet in straight run and any fraction thereof and for each aggregate horizontal change in direction exceeding 135 degrees.
- B. Install required cleanouts before back filling of horizontal pipelines.
- C. In unpaved and asphalt-paved areas, install cleanouts in yard boxes 2 inches below the yard box cover.
- D. In concrete-paved areas, extend cleanouts flush with finish grade.
- E. In traffic areas, install countersunk cleanout plugs where raised heads protrude.

3.05 ABANDONED SEWERS AND STRUCTURES

- A. Plug or cap every abandoned sanitary sewer within 5 feet of the property line in a code required manner.
- B. Demolish abandoned sanitary structures such as cesspool, septic tank, sewage pit, and manholes to a minimum depth of 5 feet below the finish grade, including removal of sewage. Disconnect any piping. After inspection, completely fill with earth, sand, gravel, cement-sand slurry, or other required material.

3.06 TESTING

- A. After installation, test each sanitary drain and/or sewer and each section between successive manholes for either infiltration or exfiltration. Test shall be conducted in accordance with Section 306 - Underground Conduit Construction of the Standard Specifications for Public Works Construction.
- B. Where excessive ground water is encountered test the pipeline for infiltration.

- C. When infiltration or exfiltration exceeds allowable amounts as set forth in the Section 306 formula, perform repairs or replacements as necessary to comply with the required limits.

3.07 CLOSED-CIRCUIT TELEVISION INSPECTION

- A. Coordinate with OAR time and date of inspection. The Project Inspector shall be present during the CCTV inspection.
- B. Prior to calling for inspection the storm and waste piping must be clean by hydro-jetting, clear, and running and not impacted by large amounts of waste water, ponding, debris and any defects during inspection and review.
- C. The CCTV camera head must be appropriately sized to fit the storm and sewer waste piping internally.
- D. Perform internal closed-circuit television inspection of lateral from the building to the public mainline. Record sewer in its entirety with no breaks or interruptions. Move camera at a speed no greater than 60 feet per minute, stopping for a minimum of ten seconds to record pipe connections, defects, and areas of concern.
- E. Locate and repair all defective sections.
- F. Maintain technical quality, sharp focus and distortion free picture. Pan, tilt, and rotate as necessary to best view and evaluate connections, defects and areas of concern.
- G. Closed-circuit Television Equipment: As a minimum equipment shall include:
 - 1. Television camera specially designed for pipe inspections, and operative in 100 percent humidity conditions.
 - 2. Camera and television monitor capable of producing minimum 470H-line resolution color video picture.
 - 3. Camera capable to inspect laterals as small as three inches up to 70 feet from sewer mainline.
 - 4. Camera lighting shall be suitable to allow clear picture of inner wall at least ten feet in front.
 - 5. The camera shall be equipped with SONDE locator capability.
- H. Defective Work:
 - 1. New Laterals: Defective Work found shall be repaired at CONTRACTOR's expense. Perform a new closed-circuit television inspection at no cost to OWNER.
 - 2. Existing Laterals:

- a. If roots, sludge, or sediment material or other defect not related to the Work of this project impedes inspection, withdraw camera, restart inspection from opposite end and notify OAR of defects found.
- b. If obstruction or stoppage was caused by Work related to this project, remove obstruction at no cost to OWNER. Perform a new closed-circuit television inspection at CONTRACTOR's expense.

3.08 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

3.09 CLEANUP

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 33 40 00

STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes storm drainage piping; sub-surface drains; metal covers, grates and frames; catch basins; box culverts; manholes, and BMPs.
 - 1. Best Management Practices (BMPs):
 - a. Proprietary Retention/Infiltration BMPs – Polypropylene or Polyethylene.
 - 2. Closed-circuit television inspection of storm drain lines.

1.02 RELATED REQUIREMENTS

- A. Section 31 2323 - Excavation and Fill for Utilities.
- B. Section 32 0117 - Pavement Repair.
- C. Section 32 1313 - Site Concrete Work.

1.03 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials.
- B. ASME: American Society of Mechanical Engineers.
- C. ASTM: American Society for Testing and Materials.
- D. BMP: Stormwater Best Management Practice.
- E. CBC: California Building Code.
- F. CCTV: Closed-Circuit Television.
- G. DET: Detention BMP.
- H. DWV: Drain, Waste, and Vent.
- I. FILT: Filter BMP.
- J. GS: Gravity Separator.
- K. HDPE: High Density Polyethylene.

- L. IAPMO: International Association of Plumbing and Mechanical Officials.
- M. IOR: Inspector of Record.
- N. NPS: Nominal Pipe Size.
- O. OAR: OWNER's Authorized Representative.
- P. PE: Polyethylene.
- Q. Post Construction BMP: Devices installed by the CONTRACTOR for storm water management to be left on site after construction completion.
- R. PP: Polypropylene.
- S. PVC: Poly Vinyl Chloride.
- T. RET: Retention.
- U. SDR: Standard Dimensions Ratio.
- V. VEG: Vegetative.
- W. OWNER: City of Murrieta
- X. SWPPP: Storm Water Pollution Prevention Plan.

1.04 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. ASHTO M 252: Geotextile Specification for Highway Applications.
 - 2. AASHTO M 294: Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter.
 - 3. AASHTO M 330: Standard Specification for Polypropylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter.
- B. American Society for Testing and Materials International (ASTM):
 - 1. ASTM A888: Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
 - 2. ASTM C14: Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.
 - 3. ASTM C443: Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
 - 4. ASTM C564: Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

5. ASTM C76: Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
6. ASTM C857: Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
7. ASTM C858: Standard Specification for Underground Precast Concrete Utility Structures.
8. ASTM C891: Standard Practice for Installation of Underground Precast Concrete Utility Structures.
9. ASTM D2564: Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
10. ASTM D2665: Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
11. ASTM D2855: Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.
12. ASTM D3034: Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
13. ASTM D3212: Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
14. ASTM D448: Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
15. ASTM F1866: Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Schedule 40 Drainage and DWV Fabricated Fittings.
16. ASTM F2306: Standard Specification for 12 to 60 in. [300 to 1500 mm] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications.
17. ASTM F2418: Standard Specification for Polypropylene Corrugated Wall Stormwater Collection Chambers.
18. ASTM F2764: Standard Specification for 6 to 60 in. [150 to 1500 mm] Polypropylene (PP) Corrugated Double and Triple Wall Pipe and Fittings for Non-Pressure Sanitary Sewer Applications.
19. ASTM F2787: Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers.
20. ASTM F2881: Standard Specification for 12 to 60 in. [300 to 1500 mm] Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications.

21. ASTM F2922: Standard Specification for Polyethylene Corrugated Wall Stormwater Collection Chambers.
22. ASTM F477: Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
23. ASTM F656: Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
24. ASTM F794: Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

C. Cast Iron Soil Pipe Institute (CISPI):

1. CISPI 301: Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
2. CISPI 310: Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

D. The International Association of Plumbing and Mechanical Officials (IAPMO):

1. IAPMO IS 6: Hubless Cast Iron Sanitary and Rainwater Systems - Installation Standards.

E. Standard Specifications for Public Works Constructions (Greenbook):

1. Section 202: Masonry Materials.
2. Section 206: Miscellaneous Metal Items.
3. Section 207: Pipe.
4. Section 208: Pipe Joint Types and Materials.
5. Section 210: Paint and Protective Coatings.
6. Section 306: Underground Conduit Construction.

1.05 SUBMITTALS

- A. Shop Drawings: Submit site plan denoting locations of lines, valves, and appurtenances.
- B. Product Data: Manufacturer's catalog data for all required materials. Include technical data for accessories, information concerning gaskets, joints and couplings.
- C. Certificates: Certificates attesting that tests set forth in referenced publication have been performed and the results required by design have been met.

- D. Closeout Documents: At Substantial Completion submit to the OAR two CD's and one hard copy of the documents indicated in paragraphs 1 through 5 below:
1. Maintenance Log: Provide Microsoft Excel Spreadsheet including the following information:
 - a. Maintenance log and upkeep records of the installed Post Construction BMPs. Include the following headers as a minimum: "Date of Service", "Location of BMP", "Type of Maintenance or Service", "Notes", "Next Scheduled Preventive Maintenance Due", and "Inspector Signature".
 - b. Maintenance Requirements: Include the following headers as a minimum: "BMP Description", "Location of BMP and Map Grid Location" and "Type of Maintenance or Service Needed", i.e.; weekly, monthly, quarterly, etcetera. "Stock No.", "Manufacturer Contact Information", along with "Frequency" namely: weekly, monthly, quarterly, etcetera and "Special Instructions".
 2. Maintenance Manuals: Provide Maintenance Manual for storm drainage BMP components installed along with requirements, replacement or maintenance schedule and plans with the location of each BMP component. This manual shall include product information cut sheet, shop drawings, vendor information for each component and warranty.
 3. Record drawings: 'As-Built' site plan(s) showing Post Construction BMP. Provide a copy of marked record set with red pencil identifying any variations from design documents.
 4. Training Documentation:
 - a. OWNER attendees sign off training sheet.
 - b. Two DVD's of materials covered in the training and components installed.
 5. Post-Construction BMP Maintenance Plan: Submit complete Plan per Attachment "A", edit per As-Built conditions and provide missing information.
 6. Records of Closed-Circuit Television Inspection: At Substantial Completion submit to the OAR three DVD's of Closed-circuit television inspections performed. Include the following information:
 - a. Electronic Media Recordings: Visual and audio record of the entire length of pipe. For existing laterals identify problem areas, such as roots, cracks, fractures, broken pipe, and other unusual conditions found.
 - b. Digital Photographs of the pipe condition, connections, points of interest and defects found. Indicate distance of defects to a point of reference such as face of building or mainline. Provide the Digital Photographs after fixing the defective pipes.

- c. Inspection Log: Provide written report including:
 - 1) Date and time of inspection.
 - 2) Name of School, Project, CONTRACTOR, and operator name.
 - 3) Location, material and size of pipe.
 - 4) Description of defects found and attempts to fix them.

1.06 QUALITY ASSURANCE

- A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction, current edition.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic products, pipes, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle all products according to manufacturer's written rigging instructions.

1.08 TRAINING OF OWNER PERSONNEL

- A. At Substantial Completion and when the storm drainage system is fully operational, knowledgeable representatives from the CONTRACTOR and manufacturer(s) of the components specified and installed at the site shall provide up to 8 hours of training. Date, time and location for the training shall be coordinated through the project OAR. Have OWNER attendees sign off training sheet and provide a copy to the OAR.
- B. Training period shall cover but not be limited to the following:
 - 1. Explain the operation of storm drainage system and its design intent.
 - 2. Explain the maintenance requirements of every component of the system.
 - 3. Provide recommendations of practices to minimize or eliminate negative impact on the system.
 - 4. Provide maintenance schedule as recommended by the manufacturers for every component and review it with OWNER's Maintenance and Operations staff.
 - 5. Conduct a site walk, identify every component of the system and demonstrate its operation.
 - 6. Training shall be conducted with the use of Maintenance log and Maintenance manual.

1.09 SURPLUS MATERIALS

- A. Provide enough additional materials for each component of BMP that requires replacement or service during the first year.

PART 2 – MATERIALS AND PRODUCTS

2.01 PIPING MATERIALS

- A. General: Minimum 5 feet away from building boundaries. For piping within 5 feet from building boundaries, and interior piping refer to Division 22 plumbing sections. Provide piping system in conformance with Section 207 - Pipe and Section 208 - Pipe Joint Types and Materials of the Standard Specifications for Public Works Construction. All Soil-tight pipes shall be provided with joints that are function of opening size, channel length, and backfill particle size. A backfill material containing a high percentage of fine-graded soils requires investigation for the specific type of joint to be used to guard against soil infiltration, including the requirement for fabric-wrapped joints.
- B. Nonreinforced Concrete Pipe (CP): ASTM C14, with bell-and-spigot ends and gasketed joints with ASTM C443 rubber gaskets.
- C. Reinforced Concrete Pipe (RCP): ASTM C76, with bell-and-spigot ends and gasketed joints with ASTM C443 rubber gaskets.
 - 1. Approved manufacturers: Thompson Pipe Group, or equal.
- D. Cast Iron Soil Pipe (CIP):
 - 1. Hubless, service weight, ASTM A888, CISPI 301, conforming to CISPI 310 and installed in accordance to IAPMO IS 6.
 - 2. Cast iron soil coupling: Hubless, heavy-duty with neoprene gaskets, stainless steel corrugated shields, and 4 bands of stainless-steel clamps. IAPMO, ASTM C564 and CISPI 310.
 - 3. Approved manufacturers: American Foundry, Mission Rubber Company, Tyler, or equal.
- E. Corrugated, Dual Wall, High Density Polyethylene Drainage Pipe (HDPE):
 - 1. Corrugated PE Drainage Pipe and Fittings NPS 4 to NPS 10: AASHTO M 252, Type S (double-wall) with smooth waterway for coupling joints.
 - 2. Corrugated PE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 294 or ASTM F2306, Type S (double-wall) with smooth waterway for coupling joints.
 - 3. Approved manufacturer: ADS, Hancor, JM Eagle, or equal.
- F. PVC (Poly Vinyl Chloride) Schedule 40 DWV Pipe:
 - 1. Conform to ASTM D2665, ASTM F794, and ASTM F1866.

2. Installer of PVC Schedule 40 DWV piping system shall carry ASTM D2855 and ASME B31.3 qualification. Installer shall provide proof of these qualifications to IOR prior to commencing work.
 3. Containers for solvent and primer shall be clearly marked with manufacturer's data. Solvent and primer shall not be more than one year old. The safety placards must be visible.
 4. Blue or red-hot glue shall not be used.
 5. Approved manufacturers and products:
 - a. Pipe: Charlotte pipe and foundry, Harvel Plastics Inc., JM Eagle, Spears Manufacturing Company, or equal.
 - b. Primer: Weld-On P-70 by IPS, Conforming to ASTM F656.
 - c. Cement: Weld-On 711 (gray) by IPS, Conforming to ASTM D2564.
- G. PVC (Poly Vinyl Chloride) SDR-35 Pipe, 6" through 15":
1. Conform to ASTM D3034.
 2. Gasketed Joints: Elastomeric gasket joints conforming to ASTM D3212.
 3. Gaskets: Chloroprene conforming to ASTM F477.
 4. Approved manufacturers: Charlotte pipe and foundry, Harvel Plastics Inc., JM Eagle, Spears Manufacturing Company, or equal.

1.02 BEDDING MATERIAL FOR PIPE

- A. General: Conform to the requirements of Section 31 2313 - Excavation and Fill or Section 31 2323 - Excavation and Fill for Utilities, as required.
- B. Approved manufacturers and products:
1. Propex Fabrics, Inc.: Geotex 451.
 2. TenCate Geosynthetics Americas: Mirafi 140N.
 3. US Fabrics, Inc.: 120NW.
 4. Equal products.

1.03 PERFORATED SUBSURFACE DRAIN PIPE

- A. Perforations shall be symmetrically located within a maximum arc of 160 degrees. Perforations shall provide a total open area of at least 0.3 square inches per linear foot of pipe, with a minimum of one perforation per linear foot, except for joint areas. Perforation shall be either holes or slots. Hole diameters of ¼-inch minimum to ½-inch

maximum. Width of slots of 1/8-inch minimum to 5/16-inch maximum with slot length not exceeding 5 inches.

- B. Aggregate Around Perforated Pipe shall be 6 inches of gravel containing no particles finer than a 1/2-inch to 3/4-inch sieve opening size.

1.04 STORMWATER TREATMENT SYSTEMS /BMPS

- A. VEG-6: Proprietary Biotreatment Devices, approved manufacturers and products:

1.05 MANHOLES

- A. Provide round reinforced concrete manhole with an H-20 traffic rated hatch & solid cover of minimum 30-inch in diameter with holes of maximum ½-inch in diameter.

1.06 MISCELLANEOUS MATERIALS

- A. Metal Covers, Grates, Frames and Accessories:
 - 1. Conform to Section 206 - Miscellaneous Metal Items of the Standard Specifications for Public Works Construction.
 - 2. Hot-dip galvanize steel parts after fabrication in accordance with Section 210 - Paint and Protective Coatings of the Standard Specifications for Public Works Construction.
 - 3. Grates and Frames:
 - a. Vandal-proof design and construction.
 - b. ADA compliant, in conformance to CBC 11B-302.3.
 - c. Rated for vehicular traffic on areas intended for use by motor vehicles.
 - d. Hot-dip galvanized.
- B. Concrete, Mortar and Related Materials: Conform to Section 32 1313 - Site Concrete Work.
- C. Manhole Brick Mortar, Grout, and Plaster: Conform to Standard Specifications for Public Works Construction, Section 202 - Masonry Materials.
- D. Underground Concrete Structures: Shall be precast and rated for H-20 traffic loading and applicable soil loads. The materials and structural design of the devices shall be per ASTM C857 and ASTM C858.

1.07 NAMEPLATES

- A. Stainless steel or aluminium nameplate permanently fastened to BMP showing the following information:

1. BMP ID number and BMP type.
2. Next service day followed by a 1-inch by 4-inch long blank space.
3. Manufacturer name, model number, telephone number and stock ID number.
4. Installation or production date.
5. 1-inch by 4-inch blank space for OWNER's use.

PART 3 – EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. CONTRACTOR shall arrange for a preconstruction meeting with the manufacturer's representative to review the basic principles for proper installation of Underground BMP type products prior to any installation.
- B. Underground Concrete modules shall be installed in accordance with manufacturer's instructions and the current ASTM C891 procedures.

3.02 EXCAVATION, BACKFILLING AND COMPACTING

- A. Conform to the requirements of Section 31 2313 - Excavation and Fill or Section 31 2323 - Excavation and Fill for Utilities, as required.

3.03 INSTALLATION OF PIPE

- A. Conform to Section 306 - Underground Conduit Construction of the Standard Specifications for Public Works Construction.
- B. Non-ferrous drainpipe installed with less than 12 inches of cover to finish grade shall be provided with a 4-inch thick concrete pipe encasement.

3.04 DRAINAGE APPURTENANCES

- A. Catch basins, junction chambers, manholes, box culverts, outlet chambers and other drainage structures: Construct as indicated on Drawings and as specified in Section 32 1313 - Site Concrete Work, and in compliance with the Standard Specifications for Public Works Construction, Section 303 - Concrete and Masonry Construction.
- B. Ensure that Post Construction BMP have a visible identifying manufacturer tag with product identification, manufacturer contact information, date of last service and date of next service due.
- C. Provide storm drain stencil per City or County requirements as applicable.

3.05 STORMWATER TREATMENT SYSTEMS/BMPs

- A. (Shall be completed by design team.)
- B. RET-4: Drywells
 - 1. The drilled holes shall be the diameter shown on the plans. The holes shall be drilled in a manner to maintain maximum permeability of soils.
 - 2. The drainage pipe, drainage screen, and filter fabric sleeve shall be suspended during backfilling operations. The drainage pipe shall extend to within 2 feet of the total depth of the drywell. The rock backfill shall be placed to prevent buckling and breakage of the drainage pipe, screen, and filter fabric.
 - 3. The overflow/riser pipe shall be installed within the drywell chamber to create a sump with depth per project detail (6' minimum).
 - 4. The pre-cast liner shall be centered in drilled shaft and the sections carefully aligned to maximize the bearing surfaces of the liner walls.
 - 5. The ring and grate shall be set to the rim elevation shown on the plans or to match existing grades and shall be secured to the cone with mortar.
 - 6. Upon completion of each drywell, a lay of UV stabilized Mirafi® 100X fabric shall be placed over the grated inlet and banded in place. The fabric shall not be removed until after paving the landscaping operations are completed.

3.06 ABANDONED DRAINAGE LINES AND STRUCTURES

- A. Cap or plug existing drain lines that are cut and abandoned and remove existing drainage structures that are abandoned.

3.07 CLOSED-CIRCUIT TELEVISION INSPECTION

- A. Coordinate with OAR time and date of inspection. Project Inspector shall be present during the CCTV inspection.
- B. Clean laterals by hydraulic jet.
- C. Perform internal closed-circuit television inspection of lateral from the building to the public mainline. Record drain line in its entirety with no breaks or interruptions. Move camera at a speed no greater than 30 feet per minute, stopping for a minimum of ten seconds to record pipe connections, defects, and points of interest.
- D. Maintain technical quality, sharp focus and distortion free picture. Pan, tilt, and rotate as necessary to best view and evaluate connections, defects and points of interest.
- E. Minimum Requirements for Closed-circuit Television Equipment:
 - 1. Television camera specially designed for pipe inspections, and operative in 100 percent humidity conditions.

2. Camera and television monitor capable of producing minimum 470H-line resolution color video picture.
3. Camera capable to inspect lines as small as three inches up to 70 feet from storm drain mainline.
4. Camera lighting shall be suitable to allow clear picture of inner wall at least ten feet in front.

F. Defective Work:

1. New Lines: Defective Work found shall be repaired at CONTRACTOR's expense. Perform a new closed-circuit television inspection at no cost to OWNER.
2. Existing Laterals:
 - a. If roots, sludge, or sediment material or other defect not related to the Work of this project impedes inspection, withdraw camera, restart inspection from opposite end and notify OAR of defects found.
 - b. If obstruction or stoppage was caused by Work related to this project, remove obstruction at no cost to OWNER. Perform a new closed-circuit television inspection at CONTRACTOR's expense.

3.08 CLEANUP

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.
- B. Maintain Post Construction BMP after installation and keep a maintenance log to be turned over to OAR at Substantial Completion.

3.09 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

END OF SECTION